



Modality and task complexity effects on second language production in CMC

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Abstract

Two decades of research on computer-mediated communication (CMC) in language learning settings has shown that integrating technology and communication leads to distinct benefits for language learning, including positive impacts on motivation, anxiety, and engagement in second language communication (Sauro, 2011). However, the majority of this research has been conducted among learners communicating via text while real-world language users are increasingly likely to communicate online in audio and video modes (Peterson, 2010). Audio and video CMC has been shown to lead to more participation (Rossell-Águilar, 2013), different uses of communication strategies (Hung & Higgins, 2016), more focus on form (Bueno-Alastuey, 2010), and higher motivation (Gleason & Suvorov, 2012; Wehner et al., 2011) among second language (L2) learners. Little is known, however, about learner language production in different CMC modalities, which influences how CMC can be integrated into teaching. The current study focuses on L2 learners' production during communicative tasks in text and video CMC. Two versions of the task were created by manipulating the task complexity variable task structure (Robinson, 2011). Production data were analyzed using measures of syntactic and lexical complexity, linguistic accuracy, and quantity of language produced. The results suggest that complexity and modality both impact the lexical complexity of language production, and that modality also affects the quantity of language produced.

Keywords: *Peer Interaction, CMC, Task Complexity, Modality*

Language(s) Learned in This Study: *English*

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CMC in L2 Learning

The ability to communicate and interact with one another online has created unique opportunities for L2 learning and teaching (Kern et al., 2008). With the rise of mobile computing and social media, as well as the ubiquity of technology in professional settings, language learners need to develop the ability to communicate effectively to be considered proficient in a language (Thomas & Reinders, 2010). CMC provides learners with new learning opportunities for communication and learning (Blake, 2007) and provides unique benefits for language learning (Lin, 2015). There are also pedagogical advantages associated with using CMC in language classrooms: CMC is a more manageable form of communication practice for large classes, as it can be conducted more quietly using headsets and because teachers can monitor and intervene in multiple interactions from a single station in the classroom (Adams & Oliver, 2019). Some research has also indicated that students who are reticent to engage in face-to-face (f2f) oral communication practice can feel less inhibited and more confident communicating online (Chen & Wang, 2009).

CMC interactions can differ in terms of modality, taking place in text only, in audio only, or in video modes.

Video CMC is considered a type of multimodal communication because information from video and audio sources contribute to the discourse (Licoppe & Morel, 2012). Video CMC more closely aligns with f2f communication, while text-based CMC unites characteristics of speech and writing with elements unique to the computational environment (Blake, 2009). While a body of research focusing on the potential of CMC for L2 learning has shown evidence of advantages for CMC in language learning (Lin, 2015), the breadth of technologies that allow for communication opportunities in CMC means that understanding of the language learning opportunities afforded by technology continues to evolve. A better understanding of how students engage in and benefit from interactions in different technology settings is necessary for understanding how technology can best be used to build language skills in the classroom. The purpose of the current study is to examine how learner language production can be influenced by the modality and complexity of a CMC task.

Text vs. Video CMC

Synchronous CMC (SCMC) interactions—interactions that unfold in real time—have most frequently been researched in text modes. Historically, bandwidth restrictions and platform stability issues for video CMC have made text-based SCMC (text chat) the most common, reliable, and affordable means of SCMC, and this remains so in many educational settings worldwide (Traphagan et al., 2010; Ubaldo, 2020). While the spread of free web-based video CMC platforms like Skype and Facetime has increased the prevalence of video chat, text chatting remains common in online chat programs, on social media platforms, in mobile computing apps, and also embedded within video CMC platforms.

Text and video chat both differ from f2f conversational interactions with implications to the opportunities they offer for L2 learning. Text chat is often described as a hybrid of speaking and writing (Smith, 2003). Similar to f2f interaction, it requires real-time, rapid exchange of information among participants. Similar to writing, text chat is carried out through letters and other writing symbols, and the end product of text chat is a visual record of the discourse (the chat transcript). However, text chat also includes features found in neither writing nor speaking. A simplified register and syntax, unique (and constantly evolving) text chat abbreviations, and the use of emoticons and punctuation in place of suprasegmental features are all common in text chat (Smith, 2003). The transmission of messages is also timed differently in text chat than speaking or writing. When we speak, our messages are produced and transmitted simultaneously. In writing, production of text and transmission to others are fully separate processes. In text chat, even though the discourse unfolds in real-time, there is a gap between the production and transmission of messages. Each turn in a text chat discourse is fully formed (and available for monitoring and revision) before it is visible to other interlocutors. This allows multiple interlocutors to produce messages at the same time and transmit them together, resulting in turn-taking patterns and divergences in the conversational flow not typical of spoken discourse (Smith, 2009).

Video chat is a closer analog to f2f speech (Bueno-Astuey, 2011). In a video chat, participants can see facial expressions and some hand gestures, can hear pausing and intonation, and so have more contextual cues for extracting meaning from the interaction. For L2 learners, this makes video chat a better site for developing and practicing oral communication strategies (Lin, 2015). However, there are still substantial differences between video chat and f2f communication. While video chat is more context-rich than text chat, participants are in different physical spaces, only interacting on screens. This limits the gestures that can be used to point out objects in the background of other speakers or to indicate the referent of a pronoun, altering the ways that meanings are expressed and clarified. It also limits a speaker's ability to use gaze to nominate the next speaker, potentially impacting turn-taking in the discourse (Helm & Dooly, 2017). Unlike f2f communication, video chat also generally includes a text channel, where participants can type messages to one another while another interlocutor is speaking. This allows learners, for example, to type out a word if the pronunciation is not understood.

Language Learning in Text and Video CMC

Chapelle (1997) called for CMC research based on the Interaction Hypothesis (cf. Long, 1996) to examine the effectiveness of CMC in promoting language learning. The large body of research inspired by her observation has focused both on the amount of learning evidenced in CMC interactions and on the many variables that may mediate this relationship. Sauro's (2011) synthesis of CMC research on L2 learning noted a strong pattern of evidence that CMC is beneficial for language learning, specifically because CMC promotes noticing of L2 forms, engagement with interlocutors in form-focused episodes, and the production of self-repair sequences. Lin's (2015) meta-synthesis of the effects of CMC on language learning similarly found that research in this area has primarily shown positive language learning effects of CMC compared with f2f communication.

Much of this research examined interactions between native speakers and language learners (e.g., in virtual pen pal programs); however, a growing body of studies has examined text-based CMC among language learner peers. These studies have found that peer L2 interactions in text chat provide unique affordances that promote language learning: that text chat can promote incidental vocabulary acquisition (de la Fuente, 2003; Smith, 2004); that it can push learners to focus on form in the context of communication (Yilmaz, 2011); that it can increase the likelihood of learners focusing on grammatical form as well as lexis (Nik et al., 2012); that it can push learners to apply a range of strategies to resolve miscommunication (e.g., Cheon, 2003; Lai & Zhao, 2006; Smith, 2008), including technology specific strategies like using *cut and paste* from the chat transcript to pinpoint negotiation triggers (Lai & Zhao, 2006). Other research, however, has found limitations of text chat. Loewen and Reissner (2009), for example, found a greater occurrence of focus on form episodes in f2f interaction than in text chat.

While researchers have discussed the accessibility and benefits of video chat (Bueno-Alastuey, 2011; Yanguas, 2010) and particularly the ability for learners to focus on aspects of oral proficiency like pronunciation and speaking fluency not accessible in text chat (Adams & Oliver, 2019), relatively little research has considered the effectiveness of video chat (compared with either text chat or f2f interactions) on promoting learning in peer interactions. Early studies have indicated that video CMC can promote language learning. Kopf (2012) found that engaging in video chat provided German-as-a-foreign-language students in New Zealand with opportunities to develop interactional skills and, in particular, practice negotiation of meaning in the context of communication, opportunities that can be limited for foreign language learners. Yanguas and Bergin (2018), comparing audio and video chat, found no differences among learners in the frequency with which they turned their attention to linguistic form; however, learners in the audio chat were more likely to drop discussions of form and leave questions about language use unanswered, suggesting that video chat might be a better option for promoting discussion of form.

Some studies have found advantages for learners engaged in voice and video chat compared to text chat. For example, Jepson (2005) also found that compared to communication in text chat, L2 audio chat interactions promote more negotiation of meaning. Jepson noted in particular that participants in the audio chat condition engaged in negotiation of meaning to resolve miscommunications that arose as the result of pronunciation errors; these negotiations are, of course, not possible in a text chat. On the other hand, studies have also shown advantages for learners who participate in text chat. Sykes (2005) compared learners engaged in text chat, audio chat, and f2f interactions on their development of pragmatic knowledge. While all three groups experienced similar growth in pragmatic competence, the learners who communicated via text chat used a wider variety of more complex pragmatic strategies, suggesting that the slower pace of text chat may help learners practice applying L2 knowledge in communication.

A limited body of research has also compared audio and video chat and f2f communication. Bueno-Alastuey (2011) compared attention to form in f2f and audio chat interactions in an EFL setting. The L1 Spanish learners either communicated f2f with a classmate or over an audio chat channel in a virtual exchange with EFL learners in Turkey. She found that students who engaged in the CMC interaction focused more frequently on linguistic form and also reported more positive impressions of the experience and its impact on their language learning. It should be noted though that these effects could also be attributed

to the fact that learners in the virtual exchange worked with interlocutors who had a different L1 and who were unfamiliar to them, while learners in the f2f conditions worked with learners who shared their L1 and were well known. It is unclear how much of the reported effects are related to CMC versus f2f communication. Bueno-Alastuey's (2013) follow-up study suggests that much of the difference was due to whether or not dyads shared an L1 rather than the mode of communication. Yanguas (2010) also compared learners interacting in f2f, audio, and video chat, measuring the effectiveness of the communication in the 20-minute task-based chat sessions for vocabulary learning through production, recognition, and aural comprehension tests. While all three groups increased their vocabulary knowledge during the study (a 20-minute task-based session), the audio chat group improved their aural comprehension significantly more, suggesting differences in learning opportunities among different modes of CMC.

These studies support Malinowski and Kramsch's (2014) point that screen interfaces may interfere with learner interaction and learning, possibly because multimodal learning materials may tax learner processing loads (Colletine, 2004). But with such a limited body of research, strong conclusions about the role of video and text CMC in peer interaction cannot be drawn. As Blake (2016) points out, "the CMC field still needs to know how L2 learners use these tools, while instructors need to identify how to best incorporate these activities into their curriculum" (p. 183). The goal of the current study is to add to the growing understanding of the nature of peer interaction in text and video CMC.

Task Complexity in CMC

While the mode of communication may influence the effectiveness of classroom CMC communication as a language learning setting, a myriad of factors surrounding the way that the task is implemented also help determine whether learning occurs. Peterson (2010) points out that the design and selection of appropriate tasks to use in CMC is key to facilitating language learning opportunities through communication. Different task designs and classroom uses of tasks impact the ways that language output is elicited, with consequences for L2 development (Stockwell, 2010). Yilmaz (2011), for example, compared the language use of students engaged in two different types of tasks in CMC: dictogloss and information-gap. Task type significantly influenced how learners focused on linguistic form as they completed the meaning-focused task, with learners engaging in discussion of language more frequently during the dictogloss task. When they did discuss form, they were more likely to continue the discussion until they had arrived at a target-like solution in the dictogloss task as well. These findings suggest that it is not only the modality used but also the tasks themselves that influence the ways that learners attend to linguistic form.

Prior research on tasks in CMC has drawn on the Cognition Hypothesis (Robinson, 2011), which offers a framework for connecting task design and implementation decision with predicted effects on the ways that learners focus their attention during language production. Robinson argues that manipulating aspects of task design and implementation can increase or decrease the cognitive demands of a task, which influences the ways that learners allocate cognitive resources to the fluency, accuracy, and complexity of language production. Through this, language development is promoted in particular and predictable ways (Robinson & Gilabert, 2007).

One of the tenets of this model is that task complexity (the intrinsic, cognitive complexity of task features) can be manipulated in ways that direct cognitive resources like attention and memory to language form (resource-directing factors) or in ways that pull attention away from language through performance or procedural demands (resource-dispersing factors). Robinson (2011) predicts that increasing task complexity along resource-dispersing (including task structure, the factor of interest in the current study) in dialogic tasks leads to a decrease in the complexity, accuracy, and fluency of resulting language production. These differences have implications for language learning, as engagement in language production can challenge learners to try out more complex forms or push them to more carefully apply their knowledge of language forms. Focusing attention on the complexity and accuracy of language production may promote the emergence of new linguistic forms (Skehan, 1998).

As a researchable hypothesis on the connection between task development and student engagement in

language use, the Cognition Hypothesis has inspired a large body of research, but relatively little research has examined the role of resource-dispersing factors in online settings (cf. Adams et al., 2015). For research in a text mode, there is some evidence that manipulating task complexity factors can influence task performance. For example, Adams and Nik (2014) investigated the effect of prior knowledge on language production in a text chat task. The findings indicated that prior knowledge of the task content enhanced the accuracy of L2 production. Adams et al. (2015) examined task structure in a text chat setting, finding that increasing task structure increased the accuracy of language production, but had no influence on complexity. These studies suggest that it may be possible for L2 learners to focus on their language production in a text chat channel if the activity is framed in a way that promotes this. Even though students may be used to using CMC for quick communication without focusing on their language use, in instructional settings the way the task is used can impact how learners produce language.

Compared to f2f communication, there is evidence that interaction in CMC, particularly in a text mode, can promote accurate and complex language production. Although some studies have found that learner communication is linguistically simplified in text chat (Kung, 2004), others have found that learners produce more lexically varied and syntactically complex language in text chat (Fiori, 2005, Sauro & Smith, 2010, Warshauer, 1995). While conventions of style for CMC communication may more commonly promote simplified language use, text and video chat in a classroom setting is quite different from casual communication. Research to date on the use of text chat in the classroom suggests that communication through a CMC mode can impact the complexity and accuracy of language use in ways that are of interest for instructed language teaching. CMC may be associated with a higher tolerance for inaccuracy and simplicity in production. But equally, aspects of text chat in particular, including the longer production time, the emerging chat transcript, and the disassociation of production and transmission of messages, may also push learners to focus more on the language they produce, leading to more accurate and complex language production.

The purpose of the current research is to examine how instructional opportunities in CMC, differentiated by communication mode and task complexity, lead to differences in language production and concomitant learning opportunities for L2 learners in an instructional setting. For mode, synchronous interactions that occur in text and video modes are contrasted. For task complexity, the effect of task structure is examined. Task complexity is a resource-dispersing variable from Robinson's (2007) Triadic Componential Framework that has previously been shown to impact the nature of language production and learner attention to form in text chat (Adams et al., 2015; Nik et al., 2012). Including task complexity in this study allows for examination of whether these effects are similar or different across communication modes in CMC.

We address the following research questions:

1. Does modality impact second language production in CMC peer interactions?
2. Does task structure impact the relationship between modality and second language production in CMC peer interactions.

This study compares learner production in peer interactions that take place of text chat and video chat to determine how the mode of communication influences the quantity, accuracy, and complexity of language use.

Research Methods

Participants

Initially, 117 engineering and business students enrolled in English for professional communications courses at two universities in Malaysia participated in the study. A large number were removed from the study due to technical difficulties (discussed below), leaving a total of 47 participants in the study. Demographic data on the participants were collected through questions on a post-interaction survey. The

students ranged in age from 18-26. Prior to their admission to university, they were all educated in Malaysian schools with compulsory English study from seven years of age. The students in this study had scores in Band 2 or higher on the Malaysian University English Test (MUET), indicating that they had basic proficiency in English allowing them to communicate interactively. They all had studied English using the same national curriculum from middle school and had all had been placed based on proficiency into intermediate level English classes in their universities. Information about the participants is displayed in Table 1.

Table 1

Participant Data

		Text chat	Video chat
Gender	Female	16	14
	Male	9	8
Major	Science and Engineering	6	18
	Business and Finance	19	4
Age	18-20	11	1
	21-23	11	20
	24-26	3	1
L1	Bahasa Melayu	23	20
	Tamil	2	
	Bahasa Melayu Sabah		2

The data collection took place in a computer lab with individual workstations for each student. Students were randomly assigned to teams of four, and teams were assigned to either text or video chat in an alternating pattern.

Materials

The students worked together in teams of three or four on a communicative role play task with an information gap stage and an opinion gap stage (teams of three were formed when necessary because of uneven numbers). The task was designed to appeal to students from both science/engineering and business/finance backgrounds and to simulate authentic workplace communication they may encounter in their fields. Three students from each team were asked to roleplay managers at different regional branches of an engineering company meeting together with a representative from the head office of the company, the fourth team member. When students worked in groups of three, one of the regional branch manager roles was not assigned. The task was focused on issues occurring in each of the branches related to worker use of technological and other resources that impacted productivity.

The participants assigned as branch managers were each directed to a webpage with information on their branch and the problems they were facing. The participant assigned as the head office representative was directed to a webpage with general information on the types of problems to discuss. They were instructed to first pool information to determine what overall problems the company faced (information gap phase) and then to discuss the problems together to create company policies that would improve the use and management of technology (opinion gap phase). At the end of the task, they collaboratively drafted a memo to the CEO outlining the problems they had discussed and the solutions they had agreed on.

While the technology use issues (like use of personal social media during worktime) were understandable by all teammates, possible solutions to the issues drew on both technical knowledge (e.g., mechanisms for

blocking or limiting access to certain sites, computational differentiation of work and non-work web use) and management knowledge (e.g., managing morale during a change, encouraging employee self-awareness and autonomy in achieving company goals). The task was designed based on input from the students' content instructors. Task materials can be found in [Appendix A](#).

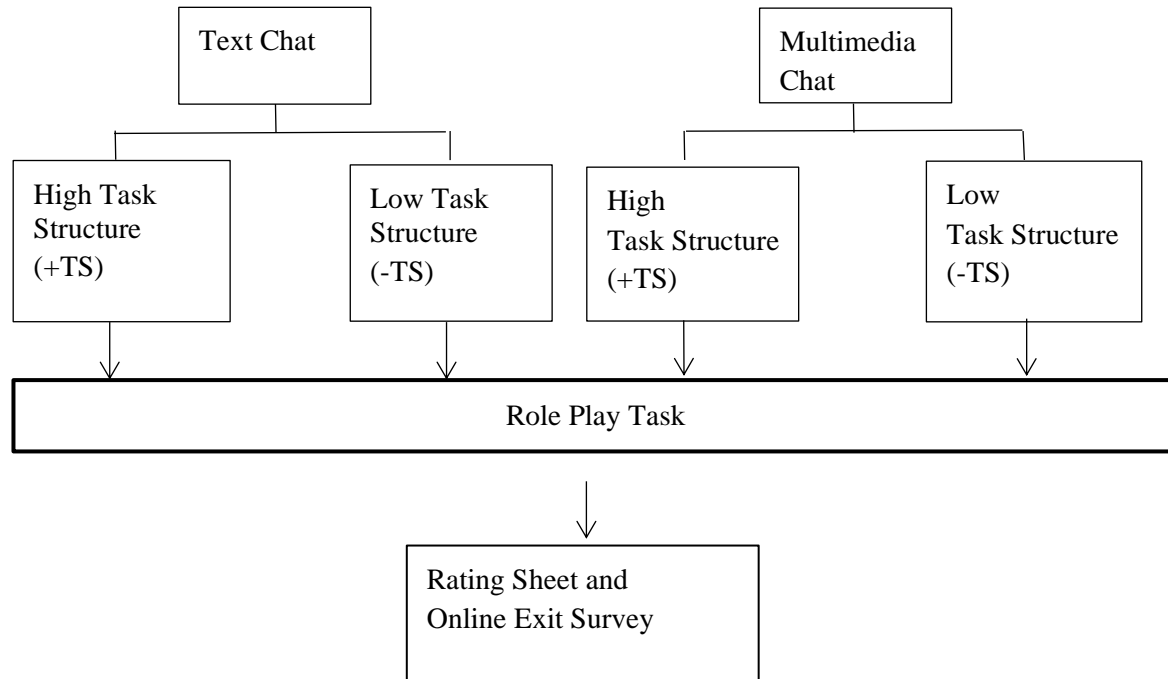
Following prior research that examined the effects of manipulating the task complexity factor of task structure in SCMC (Adams et al., 2015; Nik et al., 2012), two versions of the task were created: a basic version of the task (low task structure or -TS) and one in which students were given relatively more structure (high task structure or +TS) to help them complete the task. In the basic version of the task, participants only received the materials described above. For the more structured version of the task, participants were also given a worksheet to fill in as they worked their way through the task. The worksheet (found in [Appendix B](#)) was designed to walk participants through the process of organizing the information, grouping information from different branches on similar topics, determining the severity of the problem, and brainstorming possible solutions. It was created as an editable Google Doc and was visible to each team member, so they could all visually track the flow of information in real-time. Following the task, participants in the +TS condition were asked to indicate whether the worksheet increased the ease of communication on the task. On the post-task survey, 100% of the participants in the +TS condition agreed that the worksheet made it easier for them to engage in communication and complete the task with their team, suggesting that participant perceptions of task difficulty matched predictions that the +TS condition was cognitively less complex.

Procedure

The procedure is represented in [Figure 1](#). Data were collected in two rounds—one in each of sequential semesters—with two different groups of students. In the initial round of data collection, internet slowdowns in particular affected the performance of the video CMC teams, so data were collected with a fresh group of participants in the subsequent semester. For each round of data collection, course times across the two universities were aligned so that students could work in mixed university groups. On the day of the study, as the students arrived and logged into the computers, they were directed to a screen with information on the study and overall instructions for the task. They were informed at this point that they would be assessed by their peers at the end of the task on their participation and language use. This was done to encourage active participation and attention to language during the task. They were automatically grouped into teams of four. One of the teachers, working at a teacher terminal, placed filled groups into either the text or video condition in an alternating pattern. At this point, teams received instructions on completing the task in the appropriate modality. All teams completed the task on Skype, but for the text-only group, only the chat function in Skype was enabled.

Each participant received information for their specific role in the role-play task. The designated team leader also received a template for drafting the memo on their recommendations to the CEO. They were given five minutes to review their information, and then they were prompted to begin their meeting. In the Skype environment, the video group could see their teammates' faces and hear their voices. In the text group, they only saw the chat turns as they were posted by teammates. They were able to scroll backwards and forwards through the chat transcript as well. The participants were instructed to only use the skype client and a web browser with tabs open for the Google sheets containing the instructions, the memo template for the CEO, and the task support sheet (for teams in the +Task Support condition).

The interactions were recorded automatically using the embedded recording functions in Skype and saved on the teacher terminal. They were given 45 minutes to complete the task and their recommendation sheet. Following the task completion, they were directed to first fill in the rating sheet on their teammates' performance and then to an online exit survey. The purpose of the exit survey was to gather information on their experiences and challenges while completing the task, as well as to assess the perceived difficulty of the task as discussed above.

Figure 1*Procedure***Data Collection**

Data were recorded using the screen recording and video recording functions in Skype, and were automatically saved on the instructor terminals at each university. Initial review of the recordings made it clear that several teams experienced such severe connectivity issues during the task that they were unable to complete the task. The six task recordings from video chat with the best sound quality and fewest technical interruptions were selected for analysis. To avoid a large imbalance between text and video chat, seven text chat transcripts were randomly selected for analysis. One learner in the text chat group only produced a single turn before having to leave the task. She was removed from the study. The data set for analysis, therefore, included thirteen 45-minute task performances carried out in teams. The contributions of 47 students in total were included in the analysis.

For the text CMC chat group, the chat transcripts were cleaned following the process described in Adams et al. (2015) to allow for automatic analysis of linguistic complexity measures, which are explained below. Cleaning included correcting typos so words could be recognized (e.g., 'fulll' was revised to 'full'), using a consistent spelling across transcripts for words that do not have a standard spelling (e.g., 'owh' and 'ooh' were standardized to 'ohh'), and spelling out chat slang and jargon to match the oral form (e.g., 'b4' was revised to 'before'). This prevented lexical analysis software from misjudging the number of words in a text. For the video CMC chat group, interactions were transcribed by a research assistant and checked by the first researcher. For all data, words in Bahasa Melayu were removed before the analysis.

Coding

Transcripts for the group CMC interactions were coded to determine how the modality of communication influenced the quantity, accuracy, and complexity of language production. First, data were coded into analysis of speech (AS)-units, following Foster et al. (2000). Pause length and intonation are among the criteria used to determine whether clauses are associated with an independent clause. Because these features only exist in spoken discourse, the recommendations of Adams et al. (2015) on interpreting the use of terminal punctuation as a stand-in for pausing and intonation were followed in this study.

Two methods for coding accuracy were selected for this study. The rate of errors / AS-unit was used to measure the global accuracy rate. The proportion of error-free clauses / total clauses was also used to examine accuracy in full clauses. Because resource dispersing factors like task structure are not predicted to lead to attention to specific aspects of linguistic code like resource directing factors (Robinson, 2007), measures of accuracy in specific grammatical forms were not included.

Following Pallotti (2009), measures of both structural and lexical complexity were included in the analysis. Similar to past studies that examined task complexity factors (e.g., Michel et al., 2007; Adams et al., 2015), structural complexity was measured through embeddings. The proportion of dependent clauses to total clauses was selected as a structural complexity index. Words / AS-unit were also measured as a more global measure of complexity, following Norris and Ortega's (2009) argument that longer turns tend to be more syntactically complex.

Following recommendations from Lu (2010) on lexical complexity measures that best reflect the overall quality of L2 production, four lexical complexity measures were selected to examine the lexical density, lexical variation, and lexical sophistication of a text. Lexical density refers to the number of different lexical (as opposed to grammatical) words used in a text. It is a measure of how informationally dense a text is and is measured through the ratio of total lexical words to total words in a text. In speech, lexical density has been linked to factors including planning and interactiveness (O'Loughlin, 1995). Lexical variation (also referred to as lexical diversity) refers to the range of a speaker's vocabulary evidenced in a specific text. It demonstrates the extent to which a language user varies their vocabulary use in their language production and has been linked to global text quality (Harley & King, 1989). Lexical variation was measured in two ways: the Guiraud Index (also known as the Root Type Token Ratio) and the Corrected Verb Variation Index (CVVI), which is based on the diversity of lexical verbs in a text. Finally, lexical sophistication measures the "proportion of relatively unusual or advanced words in a learner's text" (Read, 2000, p. 203). Lexical sophistication was measured as the ratio of words beyond the 2000 most frequent words to total words in the text. The frequency of words (first 2000 or beyond) is based on the British National Corpus.

All lexical complexity measures were computationally coded using the web-based Lexical Complexity Analyzer (Lu, 2012). In order to submit the data to the analyzer, text chat transcripts were revised to be compatible with the British National Corpus. They were edited to remove spelling variation caused by typos, by the use of text chat jargon (e.g., *U* in place of *you*), by reduced spellings (e.g., *evrybdy* in place of *everybody*), by emphatic grapheme duplications (e.g., *ummmmmmm* instead of *um*), and by missing spaces between words (e.g., *verystressful* to *very stressful*). Words spoken and written in Bahasa Melayu were also removed. The use of Bahasa Melayu was very limited and was only used for interjections and word translations.

Many studies examining L2 production examine fluency of production in addition to accuracy and complexity. Fluency is generally measured through either rate of speech or through the frequency of disfluencies, such as pausing and false starts. Fluency has proven difficult to measure in interactive contexts, where disfluencies such as hesitations and repetitions may be used as turn-taking and floor-holding strategies, and may therefore not be related to linguistic or cognitive resources being applied in the interaction. For interactions taking place through a text channel, differences in fluency may also be caused by differences in typing speed rather than in language production. Because typing and speaking rates differ drastically, it is also not meaningful to compare rates of language production across text and video CMC

(e.g., Hauptmann & Rudnicky, 1990). Instead, following Adams and Nik (2014) and Adams et al. (2015), the quantity of language produced to complete the task was examined as an indication of the value of the task as an opportunity to practice producing language. Quantity was operationalized as the total number of words and the total number of turns produced by each participant in the study, and was computationally coded.

For manual coding of accuracy and structural complexity, 20% of the data were coded by the first author and an independent research assistant. The coding agreement reached 90%, which was considered sufficient for the first author to code the remaining data independently. A second research assistant then reviewed the coding on the full data set to double check for consistency.

Analysis

The descriptive statistics for each of the language production measures included in this study are displayed in [Table 2](#).

Table 2

Descriptive Statistics

		Modality							
		Text				Video			
Language Production Feature	Measure	High Task Structure		Low Task Structure		High Task Structure		Low Task Structure	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
Accuracy	Error/AS-Unit	0.34	0.22	0.45	0.27	0.39	0.25	0.28	0.07
	Error-free clauses/ total clauses	0.70	0.21	0.57	0.20	0.65	0.14	0.71	0.09
Structural Complexity	Words/AS-unit	7.50	1.30	6.59	1.85	7.24	3.42	5.74	1.74
	Dependent Clause/ Clause	0.34	0.10	0.31	0.11	0.33	0.21	0.29	0.05
Lexical Complexity	Density	0.52	0.05	0.55	0.05	0.46	0.04	0.53	0.04
	Guiraud Index	7.79	1.02	7.79	0.51	7.45	1.01	8.62	0.67
	CVVI	0.66	0.10	0.66	0.14	0.40	0.10	0.37	0.05
Quantity	Sophistication	0.21	0.03	0.21	0.04	0.20	0.02	0.25	0.03
	Words	295.20	146.77	260.27	135.16	1007.33	491.70	878.43	482.68
	Turns	27.40	19.77	29.33	14.76	142.60	64.73	105.57	76.08

Statistical analysis was used to determine whether the modality and task structure influenced learner language production in the online task. Because of lack of correlation (and lack of conceptual congruence), separate multiple analysis of variance (MANOVA) models were run for each factor (quantity, accuracy, lexical complexity, syntactic complexity) following the advice of Pituch and Stevens (2016).

Data were checked to determine whether they met the assumptions of MANOVA. There were, however, violations of MANOVA assumptions in terms of univariate outliers, the normal distribution, and multicollinearity. Where univariate outliers were found (as assessed by inspection of a boxplot for values

greater than 1.5 box-lengths from the edge of the box), the MANOVA was run twice, once with and once without the outlier values. In no case did removing the outliers change the findings, so it was assumed that the small number of outliers did not increase the risk of Type I error. Results for the full data set including outliers are reported here. Normal distributions were assessed (by Shapiro-Wilk's test, $p > .05$) for all experimental conditions. For each model, one distribution was not normally distributed. Because MANOVA is robust with respect to non-normal distributions, no modifications were made. For models where the assumption of homogeneity of covariance matrices was violated, as assessed by Box's M test, Pillai's Trace was selected as the test statistic. Where there was homogeneity of covariance matrices, Wilke's Δ was used. There was no evidence of multicollinearity, as assessed by Pearson correlation ($|r| < .9$), for any of the models with the exception of the model for quantity. This case is explained below. All other assumptions were met.

Results

Results for the multivariate analysis for accuracy, structural complexity, and lexical complexity are displayed in Table 3. Significant findings are bolded.

Table 3

Multivariate Results

		<i>F</i>	<i>df</i>	<i>p</i>	partial η^2
Accuracy*	Interaction	1.32	2, 42	0.28	0.06
	Modality	0.80	2, 42	0.46	0.04
	Task Structure	0.43	2, 42	0.66	0.02
Structural Complexity*	Interaction	0.93	2, 42	0.43	0.06
	Modality	0.94	2, 42	0.43	0.07
	Task Structure	1.30	2, 42	0.29	0.09
Lexical Complexity **	Interaction	1.72	4, 40	0.17	0.15
	Modality	20.91	4, 40	0.00	0.68
	Task Structure	4.52	4, 40	0.01	0.30

Note. *Pillai's Trace selected for Accuracy, Structural Complexity

** Wilke's Δ selected for Lexical Complexity

Accuracy

Two measures (errors / AS-unit and error-free clauses / total clauses) were included in the MANOVA for accuracy. There were three univariate outliers for this dataset, as discussed above. No significant effects were found for the interaction between modality and task structure nor for the main factor effects for modality and task structure. This suggests that neither variable (modality nor task structure) influenced the accuracy of language production.

Structural Complexity

Two measures (words / AS-unit and Independent Clause / Total Clause) were included in the MANOVA for structural complexity. There were three univariate outliers for this dataset, as discussed above. There was no significant interaction effect nor any significant main factor effects for this model. This suggests that neither variable (modality nor task structure) influenced the structural complexity of language production.

Lexical Complexity

Four measures of lexical complexity (Lexical Density, Guiraud Index, Corrected Verb Variation Index, and Lexical Sophistication) were included in the MANOVA for lexical complexity. There was one univariate outlier, as discussed above. The interaction effect between modality and task structure on lexical complexity was not statistically significant, but there were significant main factor effects for both modality and task structure. Univariate analyses for these factors are displayed in [Table 4](#). All significant findings are bolded.

Table 4

Univariate Analysis for Lexical Complexity

	Modality				Task Structure			
	<i>F</i>	<i>df</i>	<i>p</i>	partial η^2	<i>F</i>	<i>df</i>	<i>p</i>	partial η^2
Density	7.89	1, 43	0.01	0.16	13.18	1, 43	0.00	0.24
Guiraud Index	0.905	1, 43	0.35	0.02	5.19	1, 43	0.03	0.11
CVVI	66.85	1, 43	0.00	0.61	0.13	1, 43	0.72	0.00
Sophistication	1.92	1, 43	0.17	0.04	4.52	1, 43	0.04	0.10

Analysis of univariate factors indicated that there was a significant difference between the text and video groups for the CVVI (large effect size) and lexical density (small effect size). In each case, the text group produced more lexically complex language than the video group. For lexical density, the text group produced language with 12% higher proportion of lexical words, meaning that their discourse was more information heavy than that of the video group. For CVVI, the difference was larger, with the text group using 69% more varied verbs than the video group. In each case, the results suggest that the text group attended more to their use of lexis during the task.

There was also statistically significant effect of task structure on lexical density, the Guiraud Index, and lexical sophistication. The effects for the Guiraud Index were large, and for the other two indices were small. In each case, learners in the low task structure condition used more lexically complex language than learners in the high task structure condition, suggesting that for these learners, increasing the cognitive complexity of the task through a resource-dispersing variable increased their attention to lexical complexity. This is the opposite of what the Cognition Hypothesis predicts.

Quantity

As noted above, correlation analysis for the two quantity variables (total number of words and total number of turns) evidenced multicollinearity, suggesting that these variables overlap too much to be considered distinct measures. Because of this, total number of words was adopted as the single quantity variable for statistical analysis. Data was normally distributed, as assessed by Shapiro-Wilk's test ($p > .05$). The assumption of homogeneity of variances was violated, as assessed by Levene's test for equality of variances, $p = .008$. ANOVA is robust to violations of the homogeneity of variances in cases where the group sizes are similar, as in the current study.

These data were submitted to a 2 x 2 ANOVA. Results are found in [Table 5](#). There was no statistically significant interaction between modality and task structure, nor a significant main factor effect for task structure. However, there was a significant effect for modality with a large effect size. Significantly more words were produced by those in the video than the text group.

Table 5*Univariate Analysis for Quantity*

		<i>F</i>	<i>df</i>	<i>p</i>	partial η^2
Quantity	Interaction	0.19	1, 43	0.66	0.01
	Modality	38.66	1, 43	0.00	0.47
	Task Structure	0.59	1, 43	0.45	0.01

Discussion

This study examined the impact of modality and task complexity on learner language production in an SCMC group interactive task. Neither variable impacted the accuracy nor the structural complexity of the learners' output. However, modality impacted both the lexical complexity and quantity of language produced, while task complexity impacted lexical complexity.

The starkest contrast between groups was the difference in quantity of language produced. The pattern here was very clear; the team with the highest quantity of language production in the text chat condition produced less language than the team with the lowest quantity of language production in the video group, despite the groups interacting for the same amount of time and completing the same task in that time. Each group submitted a completed memo to the CEO, indicating that they had all completed the task requirements of arriving at a consensus and collaboratively writing up their decisions. Despite this, learners in the video chat group produced more than three times as many words as the learners in the text chat group.

Prior research has not contrasted the quantity of language produced in text and video chat. However, CMC researchers have pointed out that communicative interactions in text chat unfold much more slowly than in f2f communication (Herring, 1996). These differences in rate could explain in part why the text chat groups produced a substantially lower quantity of language. However, different technological affordances in text and video chat also seemed to influence the way that discourse unfolded in each, leading to different quantities of language production. One particular feature of the video data was a particularly high level of repetition. Consider Example 1 from one of the video chat teams:

Example 1 Video Chat

SA [some branches, every branches (xxx) one issue is important to the branch too (xxx) 6:11

SC [louder please]

SD ohhh, ok

SA oh, like this (1.0) three different branches, so that =

SD [ah ha]

SA =they have one branches have three issues. =

SD [yes]

SA =so that every branches suggest one issues from the, from the branches that is the most critical. and then, from the four issues the four issues from different branches. understand?

In the first turn, SA (who is role playing the manager from the head office in Kuala Lumpur) repeats variations of 'branch' as she repairs her utterance to explain the task instructions to her groups. She also repeats 'branches' and 'issues' multiple times as she holds the conversational floor to finish her idea. The transcripts from the video chat teams are replete with similar repetitions, which elevate the word counts for these data. Similar repetitions are rare in the text chat groups. This scarcity is likely related to technological

differences. Self-repairs in the text chat group likely occur before utterances are posted to the text chat (cf. Smith, 2003). Because learners can compose and monitor language before posting to the chat in the text format, language production created by self-repair is eliminated from the communication. While this makes the language production more concise, it may also limit opportunities for learners to observe and notice linguistic features in their peers' self-repair (e.g., Philp et al., 2014).

SA also repeats phrases while she formulates the remainder of her utterance and similar uses of repetition of words and phrases are found throughout the oral data. Helm and Dooly (2017) note that turn taking and other aspects of conversation management may be challenging in video chat. These difficulties may have prompted learners to turn to communication strategies like repetition that increased word counts, contributing the larger quantity of language produced by the video chat group. Differences in how the learners approached the collaborative writing phase of the task may also have impacted the use of repetitions. Learners in both groups were able to see the group leader edit the Google Doc memo to the CEO in real time. In both groups, learners made frequent suggestions about both ideas and wordings for filling in the memos. In the video CMC group, these suggestions were often repeated while the group leader was drafting, as in Example 2:

Example 2 Video Chat

- SB that's, we, we only get one, one option for this. so anybody can give any ideas. have any ideas?
- F1 online websites, ok we can add social online website
- SB what?
- F1 social online websites
- SB [social?]
- F1 social online website, to be more specific
- SB online website, social
- F1 social online website, to be more specific
- SB social
- F1 ok, are we done.

Here following SB's call for ideas, F1 suggests that they rephrase the document to read 'social online websites' (most likely referring to social media), repeating his suggestion following a clarification request, and then in his third turn, providing suggested phrasing ('social online website, to be more specific,') for the website. He repeats this exact turn while SB (the group leader) types the phrase into Google Docs. He uses repetition as a strategy to help SB remember his writing suggestions while typing in changes. While at times the video chat participants communicate without frequent repetitions, exchanges like this are very common in the video group and very rare in the text group. Because learners discussed the memo in a text format, the group leader generally simply copied and pasted suggested wordings into Google Docs. This limited the amount of talk about phrasing as the groups were engaged in collaborative writing, which likely contributed to the lower quantity of language use.

Similarly, earlier work on negotiation of meaning in text chat have found that learner engagement in discussions on language are limited. Jepson's (2005) study found that learners communicating over audio chat engaged more in negotiation of meaning than learners in text chat, and indeed a low incidence of negotiation of meaning in text chat has been noted in other studies (Loewen & Reissner, 2009). Nik et al., (2012) suggest that learners may depend on reviewing the evolving chat register rather than engaging in negotiation with peers in a text chat environment. While these studies did not consider the quantity of production in different modalities of CMC, less engagement in negotiation sequences in a text CMC setting would also lead to a lower quantity of discourse produced when completing a task.

It is possible that repetitions also contributed lower lexical complexity in the video chat because repetition inflates word counts without increasing the variety of words used. However, it is also likely that the slower pace of the text chat allowed learners to reflect on their language use, leading to greater variety in lexical choice. Smith (2008) also points out that text chat technology allows learners to compose and edit their turns before posting them to the full group. Both having time to monitor production in a discussion and being able to see language in written form may help learners focus attention on their language use.

Very little research to date has contrasted text and video CMC discourse, and none prior to this study has considered whether task features influence language production in different CMC modalities. The current study did not find that task structure impacted production differently in the two different modalities, nor did the findings suggest a large impact of task structure on production. Prior research on task structure in text SCMC (Adams et al., 2015) found that increasing task structure led to improved accuracy and (in tandem with other task features) impacted the lexical complexity of language use. The results of the current study do not replicate the finding for accuracy but do uncover an independent effect of task structure on lexical complexity. Similar to prior findings on task features in text SCMC (Adams et al., 2015; Adams & Nik, 2014), increasing task complexity led to an increase in lexical complexity in both modalities, suggesting that learners may attend to their use of lexis when cognitively challenged by an online task. As noted above, these findings are not aligned with cognition hypothesis predictions that increasing complexity along resource dispersing lines decreases the accuracy and complexity of language production. Along with prior studies (Adams et al., 2015; Adams & Nik, 2014), these findings suggest that cognitive complexity may impact language production differently in online and f2f communication.

Conclusion

The purpose of this research was to determine how language production differed in peer interaction tasks in two different modes of SCMC interaction: text and video chat. The findings suggest that while video SCMC interactions may promote more language use (and thus more language practice), text SCMC interactions may be better suited for pushing learners to extend the range of their vocabulary use on a task. This suggests that both modes are of use in pedagogical settings, but for different purposes. Teachers may choose video CMC when the instructional objectives can be served by increasing the amount of language produced and increasing the pace of interaction, whereas text modes may be more appropriate for pushing learners to attend carefully to the language they produce. Understanding these differences between modes of communication can help teachers better match the technology-enabled task to the classroom instructional needs.

In line with prior research on peer interactions in CMC, this research uncovered limited evidence that task factors impact language production online. In this study as in others (e.g., Adams et al., 2015; Adams & Nik, 2014; Baralt, 2014; Nik et al., 2012), these findings do not support the predictions of the Cognition Hypothesis. In this study, increasing cognitive complexity led to an increase in lexical complexity, while no effects were found for accuracy nor structural complexity. This adds to the growing understanding that language production in CMC can be impacted by task factors. Research on a broader range of tasks conducted in diverse settings and considering additional task factors is needed to provide teachers with advice on how to match task features to instructional objectives and language acquisition needs. However, this research suggests that the role of modality in online interactions may be a key factor in the ways that communication and opportunities for learning unfold.

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Appendix A. Sample Task Instructions

Student A

Background

This is a virtual meeting conducted via Skype on Thursday, 24th Nov 2016, at 11:00:00 GMT. The attendees are located at different states in Malaysia, i.e. Kuala Lumpur, Port Dickson, Kangar and Kuantan.

You are one of the management team at a company, *Best Gadgets Ltd*. You are based at its headquarters in Kuala Lumpur. The company has three branches located at Port Dickson, Kangar and Kuantan. Recently, the headquarters receives similar complaints from all the branches regarding the misused of the company's facilities which resulted in unnecessary expenses and low productivity workers.

The issues include, but are not limited to, the following:

1. using telephone, printer and photocopying machine for personal use
2. surfing the internet to do personal online business, to browse social media websites, and to download large size files from office computers, e.g. YouTube videos, music, games
3. stealing small items, e.g. stationary staplers, paper clips, tissue papers

Each branch has different experiences with these issues.

You and three of your colleagues have been asked by the CEO to determine the most appropriate means of managing and resolving the issues. You should consider the nature of the issue (for example, what happened, who was involved), the frequency and severity of the issue, what impact the issue has on the company, employees, and productivity, and what your options are for resolving the issue.

Your task

Your task is to meet online with your colleagues and decide together the most appropriate means of managing and resolving the issues. To do this, you will need to listen to, compare and contrast each other's suggestions. Your team must also rank the severity of the issues and finally agree on the most important issue that needs to be solved urgently. You and your colleagues will use Sheet A to guide your discussion.

Although you will simulate a virtual meeting environment, the focus of the discussion should only be about the task mentioned. You are permitted to surf any relevant website to look for additional resources to support your arguments or to argue against your colleagues' opinions. Remember that you will need to submit Sheet B to the CEO. Note that you have to complete the task within 60 minutes. It is your responsibility to discuss and communicate effectively. Following the task, you will rate each other based on the criteria of effective communications found in Sheet C.

Appendix B. Task Structure Worksheet

<p>Issue</p> <p>Analysis</p>	Issue 1	Issue 2	Issue 3	Issue 4
<p>1</p> <p>NATURE OF THE ISSUE What happened / what is the issue? Who was involved? (e.g. was it a one on one interaction or were there witnesses)? Where did the issue occur? When did the issue occur (date and time)? What factors do you think caused the issue? How did you respond/react?</p>				
<p>2</p> <p>FREQUENCY AND SEVERITY OF THE ISSUE Is this a single incident or is there a pattern of behaviour (or a series of similar issues)? If the issue has been repeated, how frequently has it been occurring? Is the issue unreasonable within the circumstances? If yes, why? What is the severity of the issue (low, moderate or high level of seriousness)? If the issue continues and is unresolved, will it get worse?</p>				
<p>3</p> <p>IMPACT OF THE ISSUE Has the company been affected by the issue? If yes, what level of</p>				

	<p>impact has the issue had upon the company (low, moderate or high)?</p> <p>If the issue continues, will your reaction to it get worse?</p> <p>Has work productivity been affected by the issue? If yes, to what level (low, moderate or high)?</p> <p>Has the situation impacted others? If yes, what level of impact has the issue had upon others (low, moderate or high)?</p>				
4	<p>POSSIBLE OPTIONS TO RESOLVE THE ISSUE</p> <p>Do not take action, only monitor the situation and find out more evidence</p> <p>Have a direct conversation with the worker</p> <p>Send the worker for counselling</p> <p>Change the shifts or duties</p> <p>Engage in workplace open discussion</p>				
5	<p>THE BEST MEANS TO SOLVE THE ISSUE</p>				

About the Authors

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