DISCOURSE FUNCTIONS AND SYNTACTIC COMPLEXITY IN SYNCHRONOUS AND ASYNCHRONOUS COMMUNICATION

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ABSTRACT

The present study investigates discourse functions and syntactic complexity in English-as-a-second-language (ESL) learner output obtained via two different modes of computer-mediated communication (CMC): asynchronous and synchronous discussions. Two instructors and twenty-five students from two advanced ESL writing classes participated in this study. Answers were sought to the following questions: a) Are the discourse functions present in ESL learners' synchronous discussions of reading assignments quantitatively and qualitatively different from those found in asynchronous discussions? And, b) which mode of CMC shows more syntactically complex learner output? The results showed that the quantity and types of discourse functions present in synchronous discussions were similar to the types of interactional modifications found in face-to-face conversations that are deemed necessary for second language acquisition. Discourse functions in asynchronous discussions were more constrained than those found in synchronous discussions and similar to the question-response-evaluation sequence of the traditional language classroom. Concerning syntactic complexity, the delayed nature of asynchronous discussions gives learners more opportunities to produce syntactically complex language. Asynchronous and synchronous CMC have different discourse features which may be exploited for different pedagogical purposes. In the hands of experienced teachers, both modes of CMC can be used as novel tools to enhance the language acquisition process by encouraging interaction among participants, collaborative text construction, and the formation of electronic communities of learners.

INTRODUCTION

Technological revolutions and the expanding use of computers are rapidly changing the nature and scope of pedagogy in all fields of knowledge. In 21st century American classrooms, computers have become indispensable tools for enhancing content and language teaching. As a result of these technological innovations, a new type of learning environment is emerging, which represents a shift from a teacher-centered to a student-centered theory of learning. As Salaberry (1996) points out, computer based telecommunications represent new types of emerging technologies that offer language teachers cost-effective tools to create learning environments that encourage purposeful interaction among learners (see comprehensive review of computer assisted language learning [CALL], multimedia applications, intelligent CALL and CMC by Salaberry, 1996). Student participation in the learning process and a shift away from a highly structured, teacher controlled environment characterizes recent pedagogical practices (Goodlad, 1994).

Along with efforts for educational reform and renewal, advances in theories of second language acquisition (SLA) have informed many of our current language learning and teaching practices. In terms of language learning, we can see a shift from teacher-centered classrooms to student-centered learning environments with certain uses of technology (Warschauer, 1997). However, this shift to student-centered learning can only take place by carefully managing the complex interplay between student needs and

characteristics, the learning activities that are computer mediated, the characteristics and reliability of the software or groupware, and the instructor's pedagogical orientations (Brandon & Hollingshead, 1999).

SLA and Computer-Mediated Communication (CMC)

Empirical studies informed by SLA interactionist theory have shown that negotiation of meaning, which facilitates comprehension of input through interactional modifications to the structure of conversation, is necessary to the overall process of language acquisition (see Long, 1981; Pica, 1987, 1994). But input comprehension in meaning negotiations or reading activities is not sufficient for language acquisition. According to Swain's (1985) output hypothesis, learner output is also necessary in promoting acquisition. Second-language (L2) learners need opportunities for what she calls "pushed output" such as speech or writing in order to develop specific grammatical features that do not seem to be acquired based solely by learning to comprehend input. The use of computers in computer-mediated communicative activities appears to provide the necessary opportunities that Swain describes.

With the increasing use of computer assisted language learning, or CALL, Chapelle (1997) cautions researchers that they need to address critical questions concerning both the kind of language learners produce in CALL activities and the quality of the language learning experience. Salaberry (1999, 104) adds computer-mediated communication (CMC) to the set of pedagogical issues to be considered in research on computer-assisted learning, arguing that CMC generates high levels of interactivity. Furthermore, he suggests that a critical study of CALL should incorporate the findings of recent theoretical and empirical studies from a sociocultural perspective (Aljaafreh & Lantolf, 1994; Crook, 1994; DeGuerrero & Villamil, 1994; Lantolf, 1994; Warschauer, 1997).

One of the most exciting aspects of CMC involves synchronous (or instantaneous) interaction on a local area network (LAN). The research literature on foreign and second language learning reports that this type of electronic discussion encourages learners to construct knowledge collaboratively (e.g., Beauvois, 1997a,1997b; Berge & Collins, 1994; Meunier, 1994; Warschauer, 1996, 1997). Additional benefits for CMC include greater participation by people in subordinate positions, women, minorities, shy students, and the physically challenged (Bruce, Peyton, & Batson, 1993; Kiesler, Siegel, & McGuire, 1984). And due to the high-quality of interaction and sharing that computer networking has been shown to encourage, some CMC researchers have claimed that "in the hands of professors who know what they are doing, online instruction is superior to face-to-face instruction" (Feenberg, 1999; Harasim, Hiltz, Teles, & Turoff, 1995).

It appears that synchronous electronic discourse is more efficient in terms of time on task than ordinary classroom discourse, and that a decrease in teacher domination of discussions creates more opportunities for the production of more complex language (Chun, 1994; Kern, 1995). There is also growing support for pedagogical claims made by proponents of CMC for greater student empowerment, autonomy, equality, and enhanced critical thinking skills (see Kroonenberg, 1994/1995; Warschauer, Turbee, & Roberts, 1996).

Second language learning opportunities are also available in asynchronous or delayed discussions (Cummins & Sayers, 1995). For example, at the Hong Kong International School, Kroonenberg (1995) used e-mail to facilitate analysis and discussion of controversial issues, such as a letter sent by the administration to parents about controlling young people's alcohol consumption. Van Handle & Corl (1998) working at different universities, used e-mail exchanges between two intermediate level German classes at both institutions to improve students' speaking and writing in German. And from a first-language (L1) composition-as-collaboration perspective, Harris & Wambeam (1996), in an experimental study, showed how a combination of both asynchronous (e-mail) and synchronous (MOO) activities enhanced the experimental students' opportunities to improve their writing skills, contribute more frequently to their on-line journals, and increase their enjoyment of writing.

Anecdotal and experimental data seem to support claims that both synchronous and asynchronous exchanges, in first- and second-language student populations, encourage interaction and help improve the quality of written and spoken discourse.

Although text-based harassment incidents in chat rooms have been reported in the literature on CMC (Hall, 1996), synchronous and asynchronous modes of CMC are powerful tools that facilitate the creation of dynamic learning environments where language is used as a tool to brainstorm, disseminate information, analyze text as it is produced, take linguistic risks, and challenge other views without fear of overt intimidation by bullies or egotists who often interrupt the most and speak the loudest in face-to-face discussions and traditional classroom settings (see McGuire, Kiesler, & Siegel, 1987; Sproull & Kiesler, 1991).

With respect to SLA research, most recent studies have focused on a comparison between learner output in computer-mediated synchronous discussions and learner output in face-to-face discussions. This exploratory study will examine the qualitative and quantitative aspects of electronic discourse functions and syntactic complexity in the written output of learners enrolled in two sections of advanced ESL writing that used different modes of CMC: synchronous and asynchronous communication.

Research Questions

Motivated by interactionist SLA research and Salaberry's (1999) recommendations for a stronger focus on interactional activities in CMC informed by a sociocultural perspective, this study investigates discourse functions and syntactic complexity in learner language generated via two different modes of computer-mediated communication: asynchronous and synchronous. Two research questions were posed: (1) Are discourse functions present in ESL learners' synchronous discussions of reading assignments quantitatively and qualitatively different from those in asynchronous discussions? And, (2) which mode of CMC shows more syntactically complex learner output?

In this study, discourse functions are defined as categories of behavior in electronic discourse, such as requests, responses, apologies, greetings, complaints, and reprimands. We define syntactic complexity as the ability to produce writing that shows how ideas and large chunks of information are represented with the use of subordination and embedded subordinate clauses. An additional construct used in this study is the electronic utterance, which is a single clause with complements and adjuncts. Although accuracy and fluency have been identified as important dependent variables in task-based SLA experimental studies (Foster & Skehan, 1996), they were not the primary focus of this investigation.

METHODOLOGY

Subjects

Two groups of university-level students from two intact English-as-a-Second Language (ESL) academic writing classes that used computers as part of the instructional program participated in this study. There were 13 students in group A, and 12 in group B. These classes were held from January to May. Students had been placed in the advanced writing courses based on their performance on departmentally mandated reading and writing exams and on two subsets of the CELT test. Because of scheduling constraints, it was not possible to design a controlled experiment; that is, students could not be randomly assigned to an experimental or control group. In this situation, it would have been highly inappropriate because most ESL students at the university are commuter students who come to campus on Friday evenings and weekends. The researcher thus had to respect students' scheduling preferences.

The students in this study ranged in age from 18 to 31 and had lived in the U.S. mainland an average of 18 months. Two of them were enrolled in graduate courses. The average number of years of schooling was 13. There were 8 males and 17 females. Six different language backgrounds were represented: Arabic, Japanese, Korean, Polish, Russian, and Spanish.

Subject Pool and Preliminary Data Collection

In order to determine whether or not there were initial significant differences between these two groups of students prior to the start of the instructional period, measures of central tendency (means and standard deviations) were compared and a t-test performed on data obtained from placement writing examinations. Though the standard deviations for each of seven indicators of syntactic complexity showed that there was a wide range of distribution of scores or variability in both groups, there was no statistically significant difference between the two groups for 7 of the 8 indicators used to measure complexity. There was, however, a significant difference between the two groups with respect to the number of error-free T-units (.044 at *p*<.05). Table 1 displays the results obtained.

In terms of syntactic complexity, several SLA researchers have pointed out that measures such as length of T-unit and error-free T-units do not capture different aspects of the writing process that measure the development of syntactic maturity. For example, error-free T-units may hide the fact that excessive coordination within a sentence might be involved, in which case the learner avoids sentence embedding altogether (Gaies, 1980; Lantolf, 1988; Ney, 1966). Thus for the purpose of this exploratory study, the preliminary means and standard deviations obtained for seven of eight indicators of syntactic complexity for groups A and B seemed to indicate that the two ESL student groups were comparable.

Indicators	Group	ˋx	*s.d.*	*t*-values	*p*<.05
Error-free Clauses	A	12.58	6.86	-1.678	.122
	B	20.25	14.05		
Total Cls.	A	29.33	12.13	-.842	.418
	B	34.33	14.62		
Error-free T-Units	A	11.16	8.14	2.271	.044*
	B	22.00	13.71	-1.678	
Total T-Units	A	15.58	6.27	-1.627	.132
	B	23.00	13.06		
Total # Words	A	217.50	69.47	-.798	.442
	B	258.41	153.28		
Total Emb. Cls	A	10.33	7.34	1.599	.138
	B	6.75	3.25		
Total Sub. Cls	A	4.41	2.46	.306	.765
	B	4.08	1.88		
T-Unit Length	A	18.77	18.69	.979	.349
	B	12.92	6.16		

ˋx=mean
s.d= standard deviation
t-values = values from t-test
p = probability level
*values significant at *p* <.05.

Group frequencies (Table 2) show that there were quantitative differences between the two groups with respect to the number of error-free clauses, total number of clauses, error-free T-units, total number of T-units, total number of words, and T-unit length. Group B had higher frequencies in five of the seven indicators of syntactic complexity. With the exception of one of the indicators of syntactic complexity,

error-free T-units (.044), the differences between the two groups for seven of eight indicators of syntactic complexity were not significant.

Table 2. Group Frequencies - Writing Placement Exam (*N*=25)

Group	Error-free Clauses	Total Cls.	Error-free T-units	Total T-units	Total words	Subordinate clauses	Embedded subord. Clauses	T-Unit Length
A	162	375	65	200	2829	59	128	14.145
B	243	412	157	276	3101	42	81	11.235

Networked Classrooms and Instruction

Classes met twice a week for six hours, and were taught by two different ESL instructors. Group A met with one instructor (the teacher-researcher) Friday evenings and Saturdays. Group B met with another ESL instructor (a graduate student in Applied Linguistics) on Friday evenings and Saturdays. The textbooks used in both courses were *Independent Writing* by O'Donnell & Paiva (1993), and *Experiencing Race, Class, and Gender in the U.S.* edited by Virginia Cyrus (1993). The students used networked computers in a teaching laboratory, and each group worked separately on CMC activities.

Synchronous discussions were part of the CMC learning activities for both groups. These were scheduled in the networked computer lab on Saturdays using Internet Relay Chat (mIRC), which is a user-friendly real time chatware developed by Khaled Mardam-Bey. Students and instructors can configure mIRC's features such as fonts, screen size, aliases, popup menus, and sounds to suit their own needs. The screen size can be adjusted and all participants are able to scroll up and down to reread previous postings and keep up with the ongoing discussion.

Computer-Mediated Learning Tasks

Students in group A spent 90 minutes Saturday mornings discussing assigned readings synchronously, while group B did the same in the afternoon session. These CMC activities were part of the six hours of language instruction. When students met in the regular classroom, they interacted face-to-face with their instructor and classmates, and often spent the remaining hour and a half discussing the readings, negotiating meaning among themselves, evaluating teacher- and peer-feedback on their drafts in small groups, and focusing on specific grammar rules.

In order to evaluate the pedagogical value of asynchronous (delayed time) communication in language learning, tasks were used which involved synthesizing and analyzing information from the book of readings. Tasks in this study are defined as learning activities with a purpose such as to summarize, analyze, respond. The purpose of the study was to generate textual discourse data from two different types of CMC modes in a computer lab setting where the tasks or activities assigned were primarily of a formal academic nature (e.g., responding, synthesizing and analyzing information). (See Foster & Skehan, 1996 for an explanation of the impact of different variables on the nature of language performance in the context of task-based instruction.)

Groups A and B, the two classes selected for this study, were comparable on several bases: same textbook, same length of instruction (one semester), same writing activities, and same type of learning environment. The goal of the CMC learning tasks or activities was twofold: to encourage fluency in writing, and to teach students how to summarize and analyze information based on readings discussed in class. The writing activities were designed to encourage the development of academic writing skills. Students had to write and rewrite their essays based on teacher and peer feedback.

While there were some differences in the amount of time students spent in the writing lab and in teacher-fronted reading activities, these were primarily due to room scheduling constraints and teacher preferences. Group B's instructor decided not to switch rooms while students were engaged in the process of writing and rewriting their drafts. Originally, the writing lab was to be used for an hour and a half, but she secured permission to use it for three hours. With respect to the teacher-fronted reading strategies instruction, scheduling of classrooms on Saturday mornings forced a slight revision in the amount of time the instructor spent teaching top-down reading processing skills. The one major difference in the learning tasks/activities consisted of the postings to the asynchronous discussion forum by group A students. Since postings were based on the topics covered in *Experiencing Race, Class, and Gender in the U.S.,* students had to learn how to synthesize and analyze the authors' writings before posting to the ESL threaded discussion forum. This was in lieu of an additional hour students would have had to spend in the writing lab writing and revising drafts.

Asynchronous Threaded Discussions

On Friday evenings, students enrolled in group A spent an hour posting to an asynchronous threaded discussion forum on the World Wide Web (WWW) their reaction to specific reading assignments on various topics: Ways of Being, Ethnic and Racial Identity, Generational Conflict, Female and Male Roles, and Economics and the American Dream. They were specifically instructed by the researcher to exchange information among themselves and respond to their classmates' postings on the Web-based discussion forum. Students were given course credit for participating in both synchronous and asynchronous discussions as specified in their Web-based syllabi.

The two teachers participating in this study met weekly to coordinate CMC learning tasks and discuss students' language learning progress. The researcher was responsible for facilitating the weekly asynchronous and synchronous discussions for group A, and the ESL instructor coordinated the synchronous discussions for group B. Both teachers had training in ESL methodology and shared similar orientations toward the teaching of writing. They favored the process approach to writing. Figure 1 below shows a breakdown by type of learning tasks or activities 1 for both groups of students, and the specific pedagogical goals both teachers sought to accomplish by asking students to engage in these activities.

Participants	Type of Task or Activity	Pedagogical Goals
Group A	Postings to Discussion Forum — Asynchronous CMC in computer lab Friday evenings (one hour).	Learning to synthesize and analyze information from *Experiencing Race, Class, and Gender in the U.S.*
Group B	Essay writing in computer lab on cultural and social topics covered in *Independent Writing*. Friday evenings with ESL graduate-student instructor.	Drafts writing and revising. Development of academic writing skills. Focus on both form and meaning.
Group A	Teacher-fronted reading strategies instruction. Brainstorming in small groups using *Independent Writing*. Friday evenings with researcher in regular classroom.	Development of academic reading skills (top-down processing), inferring, acquisition of new vocabulary. Development of writing skills.
Group B	Teacher-fronted reading	Development of academic

	strategies instruction in regular classroom and brainstorming in small groups using *Independent Writing*. Saturday mornings with ESL graduate-student instructor.	reading skills (top-down processing), inferring, acquisition of new vocabulary. Development of writing skills.
Group A	Synchronous CMC discussion based on book of readings; Saturday mornings with researcher.	Encourage fluency in writing or the capacity to engage in continuous performance online in response to teacher prompts.
Group B	Synchronous CMC discussion based on book of readings; Saturday afternoons with ESL instructor.	Encourage fluency in writing or the capacity to engage in continuous performance online in response to teacher prompts.
Group A	Essay writing in writing lab with researcher Saturday afternoons.	Draft writing and revising. Development of academic writing skills. Focus on both form and meaning.

Figure 1. Learning Tasks/Activities and Pedagogical Goals

Procedures

Synchronous discussions of 90 minutes each for both groups were collected at four different time intervals during the semester (January, February, March, and April). Although both instructors covered the same readings (ethnicity, social class, homelessness, Mother Jones, labor strikes, unionization), each of these topics were discussed synchronously at different times during the semester. The instructor in group B selected topics from the book of readings according to themes such as homelessness or social class, whereas the researcher-instructor followed the outline of topics presented in the book. In order to obtain comparable synchronous discussion data for both groups on similar topics, data were collected during the months of January and March for group A, and during February and April for group B. The data were saved on diskettes, and subsequently printed in their entirety and coded according to categories identified in previous SLA interactionist research, derived from classroom tasks in which oral face-to-face interaction was the medium of communication (see Mendonça & Johnson, 1994). Transcripts for both groups were analyzed separately for discourse functions, but the data were combined and subsequently categorized according to a scheme devised following Mendonça and Johnson, 1994. Definitions of categories and examples are provided in Appendix A.

In order to analyze the totality of discourse functions that might be present in the synchronous discussions, the synchronous data obtained from groups A and B were combined. However, for purposes of measuring syntactic complexity only, which is discussed in the following section, a sample of complete postings to the asynchronous discussion forum was compared with synchronous discussion data obtained from group B because the same topics were being discussed by both groups (e.g., ethnic and racial identity, economics and the American dream). We could not use the combined synchronous data from groups A and B to compare these with the asynchronous discussion postings because different topics were covered synchronously by students from group A (Mother Jones' union organizing activities; exploitation of garment workers).

Data collected from the synchronous discussions were coded separately by two experienced writing instructors and the researcher. An interrater coefficient of .89 was obtained, 2 and disagreements were worked out through group discussions until the three raters came to 100% agreement.

The following unedited excerpt illustrates the conversational nature of a synchronous discussion based on assigned readings:

Excerpt #1 (March 1997 — Group A)

(Learners' written output has not been edited)

<Alsushka> hey (greeting)

<Kae> Hello (greeting)

<Morrigan> Anybody there? (greeting)

<Edi> Mother "Jones" was very stuborn (response — elaboration)

<Morrigan> What did Mother Jones do to become famous? (clarification request)

<Lucy> Mother Jones was the leader of woman's voice and strike. She start leadership after her husband and four children died because of yellow-sickness. She is one of the most famous women in America. (explanation and elaboration)

<Kae> She organized a labor union. (explanation)

<Chie> She worked as a union organizer. (clarification)

The data on discourse functions in asynchronous discussions consisted of 105 postings to the ESL threaded discussion forum from January 24 through May 9, 1997. Both sets of data (asynchronous and synchronous) were approximately the same size. Some of the postings to the asynchronous discussion were two to three sentences long. Likewise, some of the exchanges in the data collected from the synchronous discussions were short greetings and directives ("Hi people," "People, talk to me!") or single electronic utterances ("Goodbye"). Not all students generated the same amount of written text in the synchronous chats.

The written output from the synchronous discussions for group A was compared to the asynchronous data obtained from the same group. There were differences in the types of discourse functions present in both the asynchronous and synchronous data. For example, greetings, imperatives, requests for clarification and information, and adversarial moves predominated in group A's synchronous data, whereas the discourse features found in the asynchronous discussions for the same group consisted primarily of topic initiation moves, questions, student responses to teacher- or student-generated questions, and comments on postings made by both teacher and students. Given the total written output obtained from these two different modes of CMC, it was determined that the two bodies of data were comparable. Thus the asynchronous data were compared to the synchronous discussion data with respect to the possible differences in the type and quantities of discourse functions.

The data selected for an examination of syntactic complexity consisted of 24 topic-specific postings on readings covered in class (ethnic and racial identity, ways of being, economics and the American dream). These postings were selected out of a total of 105 asynchronous postings to the threaded discussion forum because they represented the most complete set for students in group A at two different time periods: January 25 - February 7, 1997, and April 5-7, 1997. Because of student absences during the semester,

postings to the asynchronous discussion forum could not be randomly selected for an investigation of syntactic complexity. In terms of content and learner written output, the 24 postings selected were comparable to the two entire sessions of synchronous discussions (February and April) that were selected from group B for analyzing syntactic complexity. An interrater reliability coefficient of .92 was obtained in coding for syntactic complexity. Three raters identified and coded for eight indicators of syntactic complexity from the asynchronous and synchronous discussion data.

Defining Syntactic Complexity

To examine syntactic complexity, data were collected from two synchronous and two asynchronous discussions on specific topics: Ethnic and Racial Identity and Economics and the American Dream. The clause and T-unit constituted our units of analysis. The Minimal Terminable Unit or T-unit was first defined as the shortest unit which a sentence can be reduced to, and consisting of one independent clause together with whatever dependent clauses are attached to it. For example, *After he had eaten, Bill went to bed* would be described as containing one T-unit (Hunt, 1965). Data were coded as follows: T-units per CMC sample text (i.e., asynchronous postings and students' synchronous exchanges); error-free T-units; total number of clauses per CMC text/message; error-free clauses; total number of words per CMC text/message; total number of subordinate clauses; total number of embedded subordinate clauses; and T-unit length (total number of T-units per CMC text/message divided into the total number of words in each CMC text produced from postings or synchronous messages). [3]

Syntactic Complexity in SLA Research

In the late 1970s, SLA researchers began to apply T-unit analysis in studies of second language learning. They used the T-unit to measure the syntactic maturity of learners (Larsen-Freeman & Strom, 1977). This measure had been used extensively by first-language acquisition researchers such as Hunt (1970), O'Donnell (1976) and many others, but both first- and second-language acquisition researchers began to question its significance in assessing syntactic complexity (e.g., Gaies, 1980; Lantolf, 1988; Moffett, 1968; Schleppegrell, 1992). For example, Gaies (1980) and Ney (1966) pointed out that mean T-unit length fails to deal with excessive coordination within a sentence, and Moffett (1968) showed how a learner's use of syntactically more complex clauses could be interpreted as evidence of restricted vocabulary; that is, he/she could be using extensive circumlocution. [4]

Experimental studies investigating the effects of cognitive complexity upon the written production of learners of English as a second language (ESL) have also used indicators of syntactic complexity in assessing language development in traditional writing classes (Zhang, 1987). Learners' use of various cognitive strategies, including the use of the first language, in creating second language (L2) texts has also been investigated. For example, in a study by Kobayashi and Rinnert (1992) comparing translation as a strategy in L2 composing vs. direct composing in the L2, the researchers found that as syntactic complexity increased in the cognitively demanding translation task, awkward forms and transitional problems emerged which frequently interfered with the intended meaning.

Recent studies in networked classrooms informed by SLA theory have shown contradictory results with respect to syntactic complexity. For example, Chun (1994) and Kern (1995) found that CMC learner output showed a higher proportion of simple sentences over complex ones. In contrast to these findings, Warschauer (1996) compared the coordination index (i.e., syntactic complexity) and the type-token ratio (i.e., lexical change) of learner language produced in CMC and face-to-face small group discussions and found that students engaged in CMC discussions obtained higher values on both measures.

Despite these shortcomings, T-units and clauses were used in this study because they are easily identifiable (low-level inference categories) and provide an objective means of assessing sentence-level complexity in written texts. With respect to the asynchronous data (group A), transcripts from 24 postings

to the threaded ESL discussion forum on two topics (*Ethnic and Racial Identity and Economics and the American Dream*) were obtained. Transcripts from two synchronous sessions covering the same topics were obtained for group B. In order to measure syntactic complexity, eight indicators were initially identified and ratios calculated for both groups. (Refer to Appendix B for definitions and examples of T-units, clauses, and errors).

The following unedited posting illustrates the coding procedures used, and the often lengthy and syntactically complex learner output found in asynchronous discussions:

Excerpt #2

ESL Discussion Forum

Rosa Wakefield story

by Ina, 2/7/97

(T-units have been enclosed in brackets. Embedded subordinate clauses are shown in bold type, and subordinate clauses that show a hierarchical relationship with respect to the main clause are in bold type and italicized. Of the 16 T-units identified in this excerpt, only five are error-free.)

["The main idea of this story is that you can't deny your race, ethnic group] [and [you]can't show people how white or how american you supposed to be]. ["The real thing is **that** *even if* you are nice person, some people don't even want to talk to you, *because* of your race or nationality.] [This woman, Rosa Wakefield, tried to do the best [**that**] she could in her life.] [Everything **that** she did was perfect], [she helped her relatives, friends],[[and she] worked hard], [everybody knows **that** she is the best cook and the best housekeeper.] [She says a lot about differences between black and white people.] [One thing is *even that* the white people think a lot about everything, they are not always successful.] [She says **that** *if* she was thinking about everything like this, she'd burn her cakes and scorch skirts.] [I can't say **that** this is not true *because* there were so many situations **when** I was doing one thing and in the same time thinking about another] [and the result was, **that** I did wrong my job] [and I was depressed in my mind.] [She also says **that** people love her and treat her like the best friend, *because* she helped them a lot.] [Also she says **that** whites treat blacks like "the second kind of people…"]

An example of an evolving complex system of subordinate and embedded subordinate clauses is shown in . Ceci, one of the students posting to the ESL threaded discussion forum, spent a considerable amount of time planning her response and engaging in risk-taking behavior, which is reflected in her use of embedded clauses and more elaborate language as she struggles to explain the topic of ethnic identity in Mexico.

Coding for Discourse Functions in Synchronous Discussions

Excerpt #3 from a synchronous session among students in group A shows the discourse functions that were identified in the CMC discourse data and coded according to the categories presented in Table 3:

Excerpt #3

mIRC Session

(Group A, January 1997)

        \<Luumanh> I will kick you out anyway. (Adversarial move, 6)

        \<Alsushka> What is your problem, darling? I am your secret admirer. (Humor, 9)

        \<Morrigan> Luumanh, what are your thoughts on the last article?

        (Request for information,10) Did you like it? (floor holding move,11)

        \<Luumanh> Yeah Dr. Sotillo. It is very interesting.

        (Response:agreement, 5e; and elaboration,5a)

        \<Morrigan> What do you mean by interesting? Did you read it? (Request for clarification, 4a; and request for information, 10)

        \<Alsushka> You are computer fanatic, darling! You don't care

        about anything else, even about me!!! J (Humor, 9)

        \<Luumanh> Why do I have to care about you? (Adversarial move, 6) You are not in my class. (Assertion, 3)

        \<Alsushka> You are computer fanatic, darling! You don't care about anything else, even about me!!! J (Humor, 9)

        \<Edi> Fatima, why don't you talk? (Request for an explanation, 4c)

        \<Lucy> Fatima, why you called yourself like that? (Explanation request, 4c)

        \<Kae> Is that only the case of garment factories? (Clarification request, 4a)

        \<Edi>Fatima, I am sorry. (Response: apology, 5d)

In the excerpt above, Luumanh and Alsushka were actively involved in socializing and only marginally interested in responding to a teacher prompt. Luumanh had figured out a way of kicking out Alsushka using commands included in the instructions to mIRC users. The teacher's question (Morrigan) is finally addressed by one of the students, Kae, after seven intervening messages. The teacher had asked a question about an article dealing with underpaid and exploited garment workers. As shown by four of the postings above (Alsushka, Luumanh, Edi, and Lucy), students seemed more interested in exchanging information among themselves than in responding to teacher questions. This phenomenon has been described in detail in the literature on Electronic Networks for Interaction (ENFI) by Kremers (1993, 113-116) who found himself relegated to the sidelines when trying to lead a class discussion in real time.

Some students in group B, Excerpt #4, tried to shift the discussion away from the serious topic of homelessness by joking about it, but the instructor in this group, Lenore, often succeeded in keeping the discussion focused on the reading assignment:

    Excerpt #4

    mIRC Session

    (April 1997 - Group B)

        \<Lenore> Do you think that everyone has someone who can help them in the time of need? (request for an explanation)

        \<Saxa> When become a jobless, you become a job-hunter (response to teacher question)

        \<ruca> I thing so (agreement)

        \<sanson> yes, I think so, if you try to find some person who can help you (agreement and elaboration)

<Jellybean> I think a lot of times people are too embarrassed to ask for help. My best friend had to go on welfare and I only found out from another friend. (response to teacher prompt and elaboration)

<ruca> Poor girl, but why she didn't ask somebody also here, like a friend or something (explanation request)

<Dalila> Joie? (student asking for a classmate)

<takatook> Sorry for her but I guess she is too much… (elaboration)

<Saxa> I think let the problems become bigger enough that they could not manege them. (explanation as to why a female student became homeless)

<takatook> You have to be clever and try to find what do you need. (elaboration)

<Lenore> In the essay, it is suggested that Winterlin might be able to escape his homelessness permanently. Why is this the case? (explanation request)

<sanson> If you don't have money even to make a phone call, well call collect. (response to teacher prompt about homeless student)

<takatook> Excuse me I DON'T UNDERSTAND YOUR QUESTION. (clarification request)

<Albert> I think it's important to make good friends and family relationships. Then if we get any problem they could help…(explanation and elaboration offered in response to teacher's question)

<sanson> what question? (clarification)

RESULTS

Discourse Functions in CMC Synchronous Discussions

Table 3 displays the number and type of electronic discourse functions present in the synchronous discussion data for the two groups. The user-friendly interface provided by mIRC for real-time discussions allowed students to use the networked computer lab as a virtual meeting place. The data of four 90-minute synchronous discussions, two obtained from group A and two from group B, were analyzed and coded according to a scheme derived from previous SLA interactionist research. We thus coded for 14 different discourse functions that could be easily identified in these electronic discussions as students engaged in lively and informative student-centered exchanges. These represent "electronic moves" or units of discourse which encode specific functions, such as greetings, topic initiation moves, assertions and/or imperatives, requests, responses, adversarial moves, off topic moves, topic shifts, humor, requests for information, floor holding moves, corrective feedback, reprimands, and closings. For a conversation in slow motion to take shape, learners had to jointly construct a discourse structure, which meant initiating a request to be followed by a response or perhaps another move (request for information, clarification request, topic shift). The actual construction or production of a conversation between and among students shifted from slow motion to rapid-fire exchanges in the synchronous discussions examined.

Table 3. Discourse Functions in Synchronous Communication Using mIRC (Data from four 90-minute sessions - Groups A and B)

Categories (Electronic Discourse Functions)	Total	Teachers (*N*=2)	Students (*N*=25)

(1) Greetings	53	7	46
(2) Topic Initiation	18	12	6
(3) Assertions/Imperatives	192	23	169
(4) Requests (clarification, Comprehension checks, Explanation requests)	186	91	95
(5) Responses (elaboration Explanation, clarification, Apology, agreement)	556	74	482
(6) Adversarial Moves	44	---	44
(7) Off topic comments	8	2	6
(8) Topic Shift Moves	17	5	12
(9) Humor	66	1	65
(10) Information Requests	92	43	49
(11) Floor Holding Moves/ Topic Continuation	11	7	4
(12) Corrective Moves	14	8	6
(13) Reprimands	3	2	1
(14) Closing Moves	12	5	7
Totals	**1272**	**280**	**992**

Teacher-initiated moves accounted for 22% of all moves present in these electronic discussions (280/1272), whereas student-initiated moves comprised 78% of all moves (992/1272). Responses to teacher-and student-initiated requests accounted for 44% of all discourse functions, indicating that exchanges were indeed taking place in electronic space. Comprehension questions, requests for explanations and clarification accounted for 14% of all moves, and these were almost evenly divided between teachers and students. All adversarial moves were student-initiated, as were the majority of the reprimands. In interactionist SLA research, moves that modify the structure of the conversation (e.g., clarification requests, confirmation checks, comprehension checks) have been shown to facilitate input comprehension, which is deemed necessary for second language acquisition (Long, 1981; Pica, 1994). These types of interactional modification moves were present in the synchronous data analyzed. Other

types of discourse functions, including humor, reprimands, topic shifts, and corrective moves, were also present in the synchronous discussions and accounted for 1.1% of all the discourse functions identified and coded.

In the CMC synchronous discussions, students posted questions or responses to teacher- and student-generated questions. As shown in Excerpt #4, the rapid scrolling of messages from multiple users of the chatware (mIRC) exerted pressure on students to post short messages rapidly without paying attention to form (accuracy). There were very few long messages because these required more attentional resources to process. The software features of mIRC, which allowed communication from one to many, and from many to many, seemed to promote the loss of chronological information as a result of the intervening postings and lack of adjacency. Because of the rapid scrolling of messages, some students posted only two or three messages during the 90-minute sessions, and spent their time reading their classmates' postings. Each student worked separately at a computer terminal, but all messages posted were displayed in the front of the room on a screen using a data projector. Both students and instructor could scroll up or down to reread previous messages.

Asynchronous Discussions (Postings to the ESL Discussion Forum)

The discourse functions identified in the asynchronous threaded discussion forum were qualitatively and quantitatively different from those present in the synchronous discussions dealing with similar topics. Some of the asynchronous postings were fairly long and focused on a specific topic. Only four specific discourse functions were clearly identified from the 105 postings to the ESL threaded discussion: Topic initiation moves; student responses; teacher response/comments; and student responses or comments to other students. Twenty-one percent (21%) were classified as topic initiation moves and teacher response/comments on students' postings. Twenty-two percent (22%) of all moves were teacher-initiated. Student-initiated moves consisted of topic initiations, responses to teacher questions, and comments or responses to other student-initiated postings. As with the synchronous discussions, student-initiated moves accounted for 78% of all electronic moves. The data displayed in Table 4 below show that discourse functions in asynchronous discussions seemed to be restricted to the kind of question, response, evaluation sequence found in traditional "chalk and talk" classrooms. However, there were some topics that generated lively student exchanges.

Table 4. Discourse Functions in Asynchronous Communication Postings from January - April 1997

 (N=13 students, 1 instructor)

Type of Posting/Electronic Discourse Function	Teacher Postings	Student Postings
Topic Initiation Moves	9	13
Student Responses		52
Teacher Response/comments	14	
Student Comments or Responses to other Students		17
Totals (105)	**23**	**82**

For example, in response to one of the readings, *Ways of Being,* a Vietnamese student replies to a student from the former Soviet Union about religious beliefs and traditions. This topic was of interest to students in group A. The following unedited posting is reproduced in the student's evolving second language:

Excerpt #5

Asynchronous Discussion 1/25/97

ESL Discussion Forum (unedited)

Ways of being by Susana

Fathers and Sonsby Ina

Re: Father and Sonsby Viet

> The tradition which made your family and you weren't believers. But what do you think about tradition? In some coutries you can not change your tradition. You always have to do whatever which your grand or your parent did. You think it is good? I think it was good but it had something not good. You can not do everything which they did about 50 years or longer so. Because their socieites is not like our society. You should change if it is not good. Why not? You change it to mean you make your tradition better. I think you made a right decision. Because I think every religion teach us better. How to behave with everyone around you. If everyone behave each other like what religion teach then I think our society will be perfect. What do you think about it?

The excerpt above illustrates this student's thoughtful response to another student's posting in which she challenges her parents' beliefs by joining a church at the age of sixteen (*Fathers and Sons* by Ina):

> When I was sexsteen years old lots of my friends decided to go to the church. I was curious about it and I decided to come and see what it is all about. It was protestanic church and it was very interesting for because all I knew about christianity was Russian Orthodocsal Church, in which I never was intrested.

These excerpts from the asynchronous ESL discussion forum illustrate the cognitive process of (a) laying out the background information in a student's response to an article on cultural traditions and then (b) providing details and examples or elaborating. From these two excerpts, one can infer two cognitive processes at work: organizing the information to be conveyed and elaborating for clarification. This is accomplished by three strategies: rephrasing (e.g., "You always have to do whatever which your grand or your parent did"); sentence combining ("I was curious about it and I decided to come and see what it is all about"); and learning to use embedded and subordinate clauses (If everyone behave each other like what religion teach then I think our society will be perfect).

The numbers and types of discourse functions displayed in Table 4 show that the quantity and types of interactional functions found in the synchronous mode of CMC were not present to the same extent in the asynchronous discussions.

Syntactic Complexity Results

Syntactic complexity, defined in this study as the ability to produce writing that uses subordination and embedded subordinate clauses, is shown in Table 5 as frequency counts obtained from samples of

asynchronous and synchronous sessions. The type of embedded subordinate clauses examined in this study were generally introduced by *for, that, what,* and *which.*[5]

Additionally, t-tests were performed on the means and standard deviations of paired samples in order to determine whether or not there were statistically significant differences in terms of syntactic complexity between the written output generated under two different modes of CMC.

Table 5. Frequency Distribution of Syntactic Complexity Indicators by Type of Electronic Discussion

Type of Electronic Discussion	Error-free clauses	Total Clauses	Error-free T-units	Total T-units	Sub-ordinate Clauses	Embedded Subord. Clauses	T-unit Length (Total # Words/Total T-units)
Asynchronous (Group A) *N*=13	270	577	120	322	83	195	12.06
Synchronous (Group B) *N*=12	53	330	120	230	28	47	9.49

Table 6. Ratios of Syntactic Complexity by Type of Electronic Discussion
(*N*= 13 Group A, *N*= 12 Group B)

Type of Electronic Discussion	Error-free Clauses/Total Clauses	Error-free T-units/total clauses	Error-free T-units/total T-units	Subordinate Clauses/Total Clauses	Embedded Subordinate Clauses/Total Clauses
Asynchronous (Group A) *N*=13	0.467	0.207	0.372	0.144	0.338
Synchronous (Group B) *N*=12	0.160	0.363	0.521	0.084	0.142

Statistically significant differences at *p*<.0001 obtained for error-free clauses/total clauses between these two modes of computer-mediated communication. The data are displayed in Table 6. The distribution of frequencies in Table 5 shows that more error-free clauses were present in the asynchronous discussions than in the synchronous discussions (270 vs. 53).

In terms of error-free T-units, Table 5 shows the same frequency count for both modes of communication, but the ratios of error-free T-units/total clauses and error-free T-units/total T-units in Table 6 were higher for students in group B. Only the ratios for error-free T-units/total T-units were statistically significant (*p*=0.039) between these two modes of CMC. That is, students participating in synchronous discussions produced a higher ratio of error-free T-units to total T-units than students

participating in asynchronous discussions. These results appear to mirror data collected prior to the groups' exposure to these two different types of CMC modes; however, it is important to keep in mind that group A's postings to the ESL threaded discussion forum (the asynchronous mode) were longer and included 203 more subordinate and embedded subordinate clauses and 92 more T-units than those found in the synchronous discussion data for group B. Thus group B's written output consisted primarily of significantly fewer embedded clauses, total clauses, and T-units. In other words, they produced shorter sentences and clauses. Since both groups had an equal number of error-free T-units but group B had a total of 230 T-units compared to group A's total T-unit count of 322, statistically significant differences obtained between these two groups with respect to the ratio between error-free T-units/Total T-units.

Frequency counts in Table 5 show that students communicating in the asynchronous mode produced more subordinate and embedded subordinate clauses than students participating in synchronous discussions. The differences between the ratios for subordinate clauses/total clauses and embedded subordinate clauses/total clauses between these two modes of CMC were statistically significant, (p=0.039) and (p=0.008), respectively at p<.05. These ratios are shown in Table 6. Differences in T-unit length when comparing written output in synchronous and asynchronous communication were surprisingly not statistically significant. However, students writing in the asynchronous mode (group A) produced longer T-units than those writing in the synchronous mode (group B). (Refer to excerpts #2 and #3.)

DISCUSSION

The results of this study support previous claims made concerning the interactive nature of synchronous discussions and the overall benefits provided for foreign- and second-language learning (Beauvois, 1997b; Bork, 1997; Chun, 1994; Kelm, 1992; Kern, 1995; Kremers, 1993; Sirc & Reynolds, 1993; Warschauer, 1997; Warschauer et al., 1996).

With respect to the first research question, whether the discourse functions present in ESL learners' synchronous discussions of reading assignments are quantitatively and qualitatively different from those found in asynchronous discussions, the results clearly show that indeed qualitative and quantitative differences exist. Synchronous discussions are highly interactive and primarily controlled by students. Although there is a feature in mIRC that allows the instructor to banish unruly participants or to take control of the board, the instructors facilitating the synchronous discussions in this study did not chose to exercise this controlling option. As a result of our decision not to manipulate the flow of synchronous communication, there is a significant decrease in teacher domination of discussions. These results, which show how students challenge the traditional role of the teacher as dispenser of knowledge and authority figure, support previous findings reported by Kremers (1993) and Sirc & Reynolds (1993) who used the collaborative technique called ENFI in network-based classrooms to teach writing. This move away from traditional pedagogy toward a pluralistic and innovative pedagogy that encourages the formation of collaborative writing communities has been characterized as a paradigm shift (see Bruce et al., 1993).

There is evidence of meaning negotiations between and among participants who are discussing topics of interest to them. These meaning negotiations, which are evident from the types of questions asked and responses provided, are seen as necessary for second-language learning by interactionist SLA researchers (see Long, 1981; Pica, 1994; Pica, Young, & Doughty, 1987). The importance of studying discourse in an environment where one can see the actual construction of a conversation, including the constraints that CMC software (e.g., message size) places on interactants, has been reported in analyses of face-to-face communication and CMC discourse (see Sacks, Schegloff, & Jefferson, 1974; Cech & Condon, 1998, 258-262).

As Cech & Condon (1998, 257) explain, "typing at a keyboard for most people is more time consuming than is speaking." In this study, given the limitations of the software being used (mIRC), participants were forced to maintain topic focus while preparing their responses. This type of CMC imposes attentional

demands on participants that differ from those commonly found in face-to-face interaction (see Beauvois, 1992; Cech & Condon, 1998). As shown in the synchronous discussions analyzed (e.g., Excerpt #3), most of the postings in the present study were from one to many and from many to many; in other words, there were often multiple threads going on at the same time. Additionally, participants seemed to focus only on topics that were of interest to them and often collaborated in meaning construction and interpretation despite attempts by the instructor to shift the focus of the discussion to the readings assigned. For researchers working from a sociocultural perspective, synchronous discussions exemplify ideal environments because they encourage the intense social interaction and textual meaning construction and negotiation deemed crucial for human learning and development of higher-order cognitive functions (Vygostsky, 1978; Wertsch, 1979). The interactive nature of these online discussions promises the establishment of genuine "communities of learners" where the purpose of education is to impart autonomy to the student. (Refer to Teaching at an Internet Distance: The Pedagogy of Online Teaching and Learning.)

The rapid message scrolling and numerous intervening postings accounted for the loss of chronological information. Because there were many rapid fire responses and a great deal of socializing among students, as shown in Excerpts #3 and #4, both instructors experienced difficulty keeping the discussions focused (i.e., Morrigan with group A, and Lenore with group B, respectively). As pointed out by Ortega (1997, 89), this loss of chronological information and lack of adjacency appear to hinder systematic and reliable analyses of interactionally modified input present in the data, including evidence of the possible incorporation of lexical, syntactic, and morphological features by L2 learners. This may present a challenge to researchers seeking to apply well-established methods of analysis from interactionist SLA research to amorphous data from synchronous discussions from one to many and many to many.

Functional Uses of Language

As with face-to-face communication, the synchronous discussion data show the functional uses of language as students engaged in interaction, such as requesting personal information, flirting, making assertions, challenging classmates, and joking among themselves. Synchronous communication seems to encourage communicative fluency, which is generally understood as a quality of oral communication that expresses itself in coherence, fluidity, and appropriate lexical choice. Although there is no generally accepted operationalization of fluency, Foster & Skehan (1996, 305) measure it in terms of "continued performance and repair avoidance." Given the various discourse features identified and coded for in the present study, it appears that when students were engaged in synchronous communication, they participated more often in the ongoing discussions, often deviating from the topic under consideration and discussing issues raised by their classmates. In both the synchronous and asynchronous discussions students interacted with their classmates to a greater extent than with the instructor, but the nature of the interaction seemed more varied in the synchronous discussions. The nature of collaborative work in creating meaning through textual exchanges synchronously in electronic space appears to facilitate "learner output," which according to Swain (1985) and others is necessary for the development of the learner's linguistic system.

Most of the discourse moves identified by examining the transcribed electronic utterances (e.g., words, clauses and complements) found in synchronous discussions are similar to those present in informal conversations. For example, the following excerpt shows how some students used floor holding/topic continuation moves to keep the discussion focused on a particular topic, often monopolizing the conversation:

        <tm> My article is about the French guy named Daniel Jouvance. He believes the natural power of the ocean and the potential for its wealth of life sustaining elements.

<tm> Then he made skin and body care treatment and products.

<Magie> Music sometimes awakes different feelings. How does therapist know what kind of music is good for his patient?

<tm> He also made music that makes you relax. I think it is kind of music therapy. You can listen to that from computer if you access the home page. (floor holding move)

<tm> Magie, I agree with you.

<tm> I guess nobody knows about the importance of plankton in the ocean. (Floor holding move; tm is unwilling to relinquish the floor and begins discussing another topic; excerpt from Appendix A, category 11.)

There was also some evidence that students noticed errors in spelling, grammar, and punctuation, and occasionally corrected each other:

<Chinche> and what kind of education is that??

<Cucarron> it is just a fact of independent ideas, if people want to educate their children at home they can organize their lifes with a very strictic program in order to do the right thing.

<JCQH> Yeah! But don't you remember the nice time that you spent at school with children your edge?"

<Jellyman> you can give this moral to your children also at home

<Nita> School teaches history, geography, math, and science, biology, arts and some more subject.

<Cucarron> I remember those days, at that AGE. NOT EDGE! (Excerpt from Appendix A, category 12.)

To encourage self-correction and accuracy in writing, perhaps one solution for ESL writing classrooms would be to distribute transcripts from synchronous discussions and ask the learners to study and critique their own and others' use of the L2. This type of activity would provide an appropriate context for L2 learners to focus on form as part of the language learning process.

The findings of this study are consistent with the tenets of interactionist SLA research (as described in the work of Pica, 1994, and Pica et al.,1987) and seem to address some of Chapelle's (1997, 1999) critical questions (e.g., How good is the language experience in CALL for learning? Do learners produce "comprehensible output"?) The results show that learners produce more informal electronic speech and utilize a variety of discourse functions when they exchange ideas and information with their classmates in a synchronous mode than when posting to the asynchronous discussion forum.

In the asynchronous discussions (the threaded ESL discussion forum), students participated in information exchanges, challenged each other's views, questioned new concepts, but primarily responded to teacher and student questions. Thus the quantity and quality of interaction was largely constrained in this mode of CMC. Some topics generated more student interaction than others. For example, the readings on *Ways of Being* generated a total of 19 student exchanges, including a Vietnamese student's critical response to a Russian student's posting on religion and tradition (*Fathers and Sons*).

In general, student output in the asynchronous discussions was lengthy and more syntactically complex than that available in synchronous discussions (c.f., Edy's postings in Appendix C and the synchronous exchanges in Excerpts #1 and #3.) While students communicating synchronously seemed to focus on

meaning and disregard accuracy, those communicating asynchronously had more time to plan their answers and monitor spelling and punctuation. However, malformed sentences and inaccuracies in spelling and punctuation were evident in many of the asynchronous postings.

While both modes of CMC (synchronous and asynchronous) presented ESL learners with opportunities to practice and expand their fluency in ways that differ from conventional oral and written classroom practices, not all students took advantage of this opportunity. In the asynchronous data examined, 49% of the discourse functions identified were classified as student responses to teacher questions or prompts. Asynchronous discourse functions identified were similar to those found in traditional language classroom discourse: teacher request — student response — teacher evaluation. Yet there were many instances where students, while not often threading their responses, posted sequentially in response to teacher queries, addressed issues brought up by each other, presented many types of elaboration and explanation (e.g., Ina's and Edi's long postings, and Ceci's complex sentences shown in Appendix D), signaled humor, and suggested agreement and disagreement in indirect ways (e.g., Viet's agreement with parts of Ina's argument in Excerpt #5). In other words, students responded to other students' postings in the threaded ESL discussion forum when the issues addressed were directly relevant to their own personal experiences.

Concerning the second research question, which mode of CMC shows more syntactically complex learner output, the results indicate that learners used more subordinate and embedded subordinate clauses in their written output while posting to the asynchronous discussion forum than when communicating synchronously. An example of the complex level of embeddedness found in many of these postings is illustrated by the excerpt and tree diagram displayed in Appendix D. Research has shown that using progressively more complex language is also an indicator of the cognitive processes involved in the act of composing and revising texts (Daiute, 1986; Hawisher & Selfe, 1989; Kobayashi & Rinnert, 1992). These processes seemed to be at work as students composed and revised their postings to the asynchronous discussion forum.

 The average T-unit length also increased in asynchronous discussions when compared to data from synchronous discussions (12.06 vs. 9.49, respectively). When coding and examining the synchronous data for syntactic complexity indicators, we found numerous "fragments" or electronic utterances (i.e., words, clauses, or sentences usually found in face-to-face interaction) that did not constitute traditional units of analysis in written texts (e.g., sentences, s-nodes, c-units). 6/P>

The data appear to show that the asynchronous mode, to a greater extent, provides opportunities that would seem to facilitate the use of more complex language than the synchronous mode. This may be explained by the fact that writing in delayed-time conditions is affected by audience expectation (teacher and other students as audience), the nature of the task (in this case, responding critically to specific academic readings), and the need to adhere to time constraints (e.g., one hour) in organizing one's response and identifying the main ideas in the readings. Since these students were writing for academic purposes, their goal was to produce well-structured essays within a specific time frame.

The threaded ESL discussion forum also gave L2 learners opportunities to orally discuss their ideas with their teacher and classmates prior to posting to the discussion forum, plan their responses, and organize their material. These are all features generally found in the traditional ESL writing classroom in the form of oral discussions in large or small groups. Thus the kinds of written texts students produced in the asynchronous mode contained features that are representative of formal written discourse.

The fact that many of these postings contained grammatical inaccuracies might be related to one of Foster & Skehan's (1996) findings concerning complexity. According to Foster & Skehan (1996, 303), "complexity emphasizes the organization of what is said and draws attention to the progressively more elaborate language that may be used, as well as a greater variety of syntactic patterning." It also reflects

the learner's risk taking behavior in using more advanced forms of the target language and coping with the demands of cognitive processing time and effort. Students experimenting with more complex language probably had little energy left for monitoring sentential errors. This is exemplified by Ina's extensive use of subordinate and embedded subordinate clauses in Excerpt #2. Ina is clearly using forms closer to "the cutting edge of interlanguage development" (Foster & Skehan, 1996, 304).

Though synchronous communication is text-dependent, it would seem that fluency or effective ongoing discourse, but not syntactic complexity or accuracy, is facilitated via this mode of CMC. Given the conversational nature of synchronous discussions, where electronic utterances predominate, it was difficult to measure syntactic complexity because these utterances were not coded as either T-units or clauses.

These results partially confirm previous findings by Kern (1995), who reported loss of grammatical accuracy and lack of coherence because of the fast pace of the discussions taking place in real time. However, as shown in the results section, despite the cognitive processing time constraints and effort involved in tracking a discussion thread in the synchronous discussions, error-free T-units/Total clauses and error-free T-units/total T-unit ratios were higher for students in group B than for students in group A. That is, there were significantly fewer errors found in the more informal synchronous exchanges of group B than in the asynchronous discussion texts produced by students from group A.

Although there are many plausible explanations for the fact that group B produced higher error-free T-units/total clauses and error-free T-units/total T-unit ratios than group A, one of the most important explanations is the degree to which learners control speech/writing mechanisms. The error-free T-unit ratios data displayed in Table 6 seem to mirror the data collected prior to the CMC activities, where group B produced a significantly greater number of error-free T-units in the pre-test. This can best be explained in terms of the type of CMC involved. Group B learners were engaged in real-time (synchronous) communication, which entails different language information processing and production mechanisms (Wei, 2000). These learners were operating at the lexical-conceptual structural level, which conflates universally available semantic and pragmatic information (Wei, 2000, 109-114). These students produced significantly shorter sentences because their immediate attention was focused on conveying information directly.

They were asking questions, clarifying information previously discussed as their classmates' postings scrolled by. In stark contrast, students in group A posting to the asynchronous discussion forum paid more focal attention to language forms and grammatical structure. They fully exploited lexical choices and syntactic structures available to them (e.g., subordinate and embedded subordinate clauses). Group A students seemed to be operating at the predicative-argument structural level "which specifies the properties of verbs in different subcategories and how the expressed arguments are encoded grammatically," (Wei, 2000, 109). Their use of surface devices for word order, agreement and tense/aspect marking represents their morphological realization patterns.

It thus appears that different cognitive processing demands are placed on student performance by these two modes of CMC. The effects on learners' grammatical accuracy of different types of cognitive demands by learning task have been shown by Foster and Skehan (1996) in their study of planning and task type in SLA. Their findings indicate that for each task, undetailed planners produced the most accurate level of language performance.

Finally, with respect to overall syntactic complexity, the length of the postings to the ESL threaded discussion forum and the students' risk-taking behavior in using more elaborate language seem to account for the fact that students in group A produced more subordinate and embedded subordinate clauses than students from group B who were communicating synchronously.

CONCLUSIONS AND IMPLICATIONS

A paradigm shift seems to be underway in classroom relations and means of delivering information as a result of recent technological innovations. The extent to which teachers manage classroom discussion, provide feedback or reframe their intervention involves a complex interplay between and among several key factors. For example, the rationale behind using CMC in a course, the instructor's pedagogical orientation and instructional goals, and the features of the software utilized affect the learning outcomes and effectiveness of the students' language learning experiences (see Brandon & Hollingshead, 1999).

 As some researchers investigating the role of CMC in the teaching of content, second languages and writing skills have shown, teacher domination of discussions and control of the knowledge base seem to be challenged by the students' degree of participation in both synchronous and asynchronous modes of communication (Berge, 1995; Kremers, 1993; Miller, 1993; Sirc & Reynolds, 1993; Warschauer, 1997). In this study, both teachers tried to keep the discussion of academic readings focused, as in Excerpt #1, by reframing questions, scaffolding, and providing implicit corrective feedback through modeling. The teacher in group B succeeded in keeping the discussion focused (Excerpt #4) for longer stretches of discourse, but students often managed to change the topic. This should not be seen as a weakness but rather as part of a collaborative learning process found in purposeful action (Vygotsky, 1978). [7] Furthermore, student collaboration and text construction in both modes of CMC, especially synchronous communication, seem congruent with the text-mediational interpretation of Vygotsky, which views texts as thinking devices that allow learners to generate new meanings collaboratively (Wertsch & Bivens, 1992). As anecdotal evidence and the results of recent experimental research have shown, this learner-centered aspect of CMC technologies enhances learning opportunities for students (Berge, 1995; Harasim, 1987).

Asynchronous discussions in particular allow language learners more time to plan their writing, edit their spelling, grammar, and punctuation when paying attention to form, and make longer contributions than students composing synchronously. Asking students to respond to challenging academic readings encourages them to think critically and post carefully prepared responses to teacher and student queries. Learners are thus able to focus on both form and meaning to a greater extent than when they are engaged in rapid fire exchanges and socializing via synchronous discussions.

Since student postings to the asynchronous ESL discussion forum were saved for the duration of the academic year, learners were able to gauge the development of their second language writing skills. Data collected from synchronous and asynchronous discussion groups could be used in carefully planned longitudinal studies.

There are limitations concerning the findings of this study. First, the number of students participating in this study was relatively small (25). Second, these were two intact ESL classes, which meant that students were not randomly selected or assigned to different treatment groups (synchronous vs. asynchronous CMC). Third, unlike previous SLA studies on computer mediated communication, this study used T-units, subordinate clauses and embedded subordinate clauses as indicators of syntactic complexity rather than lexical density, lexical range, or coherence and cohesion devices, which are also used in L1 and L2 composition studies (e.g., Ferris, 1994). Fourth, it is possible that differences in teacher intervention and personalities in these two types of CMC might account for the significant decrease in teacher domination of discussions. The researcher-instructor chose not to intervene directly in the CMC discussions, opting for guiding the discussions as opposed to controlling the content, whereas the ESL instructor who monitored two of the synchronous discussions with group B tried to keep students focused on the academic readings. Future research could control for differences in teacher participation in CMC discussions, task design, and time spent on CMC writing activities. Given these limitations, these findings should be considered only indicative of patterns that might be found with other ESL student populations.

In conclusion, it seems appropriate to point out that while these technological innovations foster changes in power relations in the classroom, facilitate massive information exchange, and encourage learner autonomy, they are ultimately tools or adjuncts in the hands of instructors who must use them creatively to maximize the students' language learning experience. Although face-to-face interaction in language learning situations is still essential for making oral input comprehensible and facilitating the restructuring of the learner's evolving linguistic system, CMC technologies have the potential to enhance the process of second language acquisition and encourage the formation of electronic communities of learning. Future research studies on language acquisition based on the impact of various modes of CMC and multimedia developments will form part of the research agenda for the 21st century.

APPENDIX A

CODING CATEGORIES DEFINITIONS

1.	Greetings	Opening move in a synchronous discussion	"People talk to me!"
2.	Topic Initiation	Suggesting a topic in a synchronous discussion	"Let's talk about beach erosion."
3.	Assertions/ Imperatives	Declarative statements; commands	"This is really terrible, but it's the law…"
4.	Questions/ Requests	pecific electronic speech acts based on Long (1981): (a) clarification requests; (b) comprehension checks; (c) explanation requests	"Is that only the case with garment factories?" (4a); "Why did she feel that NASA was responsible for her loss?" (4c).
5.	Responses	(a) Elaboration; (b) explanation; (c) clarification; (d) apology; (e) agreement	Examples of elaboration and explanation, respectively: "I have been interested in classical music since I began to learn piano. I knew that music was not only for people to make happy, but also for patients who have emotional and physical handicaps," (5a) and "because her father was working in NASA," (5b).
6.	Adversarial moves/ challenges	Electronic speech acts where one participant challenges another	"Do you only read cheap magazines?"
7.	Off Topic	Electronic speech act that deviates from the topic under discussion	"You are crazy, boyfriend! You are crazy, boyfriend!"
8.	Topic shift moves		"I think we should now move on to your article."
9.	Humor		"Vietnamese movie is not good. It is very cheap…J .J "
10.	Request for information		"Where does one find the worst beach erosion in New Jersey?"
11.	Floor holding moves/ topic continuation	Electronic speech acts where one participant tries to keep the conversation going and is unwilling to relinquish his/her turn, as in the following sequence	<tm> My article is about the French guy named Daniel Jouvance. He believes the natural power of the ocean and the potential for its wealth of life sustaining elements

<tm> Then he made skin and body care treatment and products.
 <Magie> Music sometimes awakes different feelings. How does therapist know what kind of music is good for his patient?
 <tm> He also made music that makes you relax. I think it is kind of music therapy. You can listen to that from computer if you access the home page. (floor holding move)
 <tm> Magie, I agree with you.

<tm> I guess nobody knows about the importance of plankton in the ocean. (floor holding move)
 <Inanna> Ing, music helps when one is depressed. What type of music do therapists recommend for people who are depressed?
 <Ing> I believe that music is spiritual thing. Music reproduces the mood and spirit of the composer; of the moment he composed it.
 <Inanna> Yes, anyone can play an instrument, sing beautifully like the sopranos and tenors, or compose music if truly gifted…." (floor holding move)
 <futsuunonko> Music is a very trace that the composer made.

| 12. | Corrective moves | As in the following sequence | <Jellyman> In at home also you can take a tutor from teacher no need to be parents |

<Chinche> and what kind of education is that??
 <Cucarron> it is just a fact of independent ideas, if people want to educate their children at home they can organize their lifes with a very strictic program in order to do the right thing
 <JCQH> Yeah! But don't you remember the nice time that you spent at school with children your edge?"
 <Jellyman> you can give this moral to your children also at home
 <Nita> School teaches history, geography, math, and science, biology, arts and some more subject.
 <Cucarron> I remember those days, at that AGE. NOT EDGE!

| 13. | Reprimands | "Margo, you are rude!!!" |
| 14. | Closing moves | "Class, for next week, I want you to read the following articles…" |

APPENDIX B

GUIDELINES FOR CLAUSES, T-UNITS, WORD COUNTS, AND ERRORS

T-Units: Working Definitions

A T-Unit is defined as either an independent clause and all its dependent clauses (e.g., "When they graduated from college, the government let them work in Beijing"), or as an independent clause only (e.g., "He came to this country to continue his education").

Examples of two T-units: "[In 1991, my husband got a scholarship from Louisiana Tech University] [and he came to this country to continue his education]."

a. Count run-on sentences and comma splices as two T-Units with an error in the first T-Unit. Example: "Problems will always exist between humans regardless of race or ethnic background or anything, it is part of the human existence equation."

     T   T
     1 error   1 error-free

b. Do not count sentences fragments.

c. If a NP is standing alone or a subordinate clause is standing alone, do not count them as T-Units.

d. When there is a grammatical subject deletion in a coordinate clause, count the entire sentence as one T-Unit.
     Example: "More and more women should take an active part in society and use their ability to helps others."

e. Count S-nodes with a deleted complementizer as an embedded clause as in: "The main idea of this story is that you can' t deny your race or ethnic group and [that] you can't show people how white or how American you are supposed to be."

f. Direct quotes should be counted as follows: "I don't trust anybody who would deny their color like that." (1 T-Unit)
     "They can't stand the idea of anything good being black. If a black person does something good, they say he did that because of the white in him." (2 T-Units)

g. Count the following as subordinators: after, although, because, if, until, where, since, when, while, as if, as though, so that, in order that, so as, in order, as (many) as, more than, although, even though, despite, so (that).
     Example: "In order not to pick poisonous mushrooms, you must know much information about all kinds of mushrooms."

h. Count T-Units in parenthesis as individuals T-Units.

Clauses: Working Definitions

In this study two main types of clauses were included.

a. Finite clause. A clause equals an overt subject and a conjugated verb, or a verb that is preceded by a modal (will, would, can, may, should, and so on).
Example: "Japanese high school girls make a lot of money and buy Chanel, Gucci, etc." "I will visit my family next year."
Normally, a finite embedded clause is introduced by the complementizer *that.* (e.g., "I thought *that* things were not so difficult in this country"), while a finite subordinate clause can be introduced by any of the above subordinators. (e.g., "When one comes to this country,…")
Finite clauses can stand on their own as grammatical sentences or as the main clause of a larger clause if the complementizer is omitted. (e.g., "I studied medicine in my country.")

b. Nonfinite Clauses. These types of clauses differ from the others in that they do not have an overt subject and the verb is preceded by *to.* Nonfinite embedded clauses are introduced by *for,* and although this complementizer is omitted sometimes, they cannot stand on their own as do finite clauses. ("We are going *to live in San Francisco.")* (Jacobs, 1995, 50,81-82.)

c. Imperatives do not require a subject to be considered a clause as in: "Talk to me people!"

d. In a sentence that has a subject with only an auxiliary verb, do not count the subject and verb as a separate clause. (e.g., "Cecilia is sad and her mother is too.") (Polio, 1997, 138-139.)

Error Guidelines

a. Count as error improper spelling of proper nouns, geographic sites, and corporate names.

Example: "We cannot say that racial problem is over and franclin's circle is full."

(Three errors = article deletion, no capitalization, and incorrect spelling of proper name.)

"I am from Mexico." (1 T-Unit, proper capitalization.)

b. Count missing commas in restrictive clauses, inappropriately placed commas, and missing commas after prepositional phrases as errors.
Example: "John my next door neighbor is a person who spent his time doing nothing but watching t.v." (Errors in tense and comma omission; 1-T-Unit.)

c. Count tense/reference errors only within the context of the preceding discourse
Example: "I did my best every time I cooked. Then I realize that I really like cooking." (Deletion of regular past tense marker —ed.)

d. Count overgeneralization of —ed marker and plural —s to inappropriate contexts; omission of third person singular, -s marker.
Example: "I was borned in Mexico city which is a huge city." (Overgeneralization of —ed marker.)
"How come no one respond to me?"
"At meal or breaks times students take the streets." (Overgeneralization of plural —s marker to an inappropriate context.)

e. Count article omissions as errors.

f. Count errors in capitalization.

g. Count as error non-native usage errors in syntax and morphology.

APPENDIX C
ESL THREADED DISCUSSION FORUM

Ethnic and Racial Identity
by Susana, 1/24/97

Franklin (In Experiencing. . . (1993), p. 19) writes: "If the history of ethnicity has meant anything at all during the last three centuries, it has meant the gradual but steady retreat from the broad and healthy regard for cultural and racial differences to a narrow, counter-productive concept of differences in terms of whim, intolerance, and racial prejudice. We have come full circle." Do you agree or disagree with Franklin's argument? What arguments would you offer to support or refute his analysis?

> Sample of threaded discussions:

> History of Ethnicity During the Last Three Centuries by Ceci 1/25/97

> Changing Attitudes by Susana 1/30/97

> Ways of Being by Susana 1/24/97

> A Message from Hopi to Our Modern Societies by Ceci 1/24/97

> Fathers and sons by Ina 1/24/97

> Re : Father and Sons by Viet 1/25/97

> Religion and Tradition by Susana 1/30/97

> The Elephant. by Edi 1/24/97

> My parents and me: Two generations by Ceci 1/24/97

> different types by S. K. 1/25/97

> Response to Two generations by Dr. Ina 1/25/97

> Response to Two generations by Dr. Ina 1/25/97

> No Taboos by Ceci 1/25/97

> The beliefes by S. K. 1/24/97

> Re : beliefes by Vi 1/25/97

> Great Attitude! by Susana 1/30/97

**Economics and American Dream (unedited posting)**
by Edi 4/5/97

> Mack and Glennon come from different social classes. She is a member of the working family and he belongs to a higher social class. That is way, their behaviour, language, and dressing style are completly different. Mack uses the slang which is typical for his social class but it sounds strange for his partner. Glennon feels a great distance between herself and Mack and she describes her position as a "marginal". She wants to decrease the distance between them by erasing " any trace of her lower station".

According to Ruth Sidel " the persistent poor" is a person who lives in poverty eight of the ten years. She states that group contains one-third of elderly living in rural areas. She also considers black households and female- headed hauseholds as groups of persistend poverty. The femalization of poverty is coused by social and economic factors. Women bear more responsibility for their family, and employers believe that they cannot work as effectively as men. So, they are discriminated at the work. In many cases, they are also dependent on men who make main income and suport family. When women become a head of hausehold, they find a lot of difficulties to get a job. As a result, they become dependent on a welfare fund.

APPENDIX D

EMBEDDED SUBORDINATE CLAUSES TREE DIAGRAM AND EXCERPT

I agree with Franklin that this century has been difficult to the history of ethnicity.
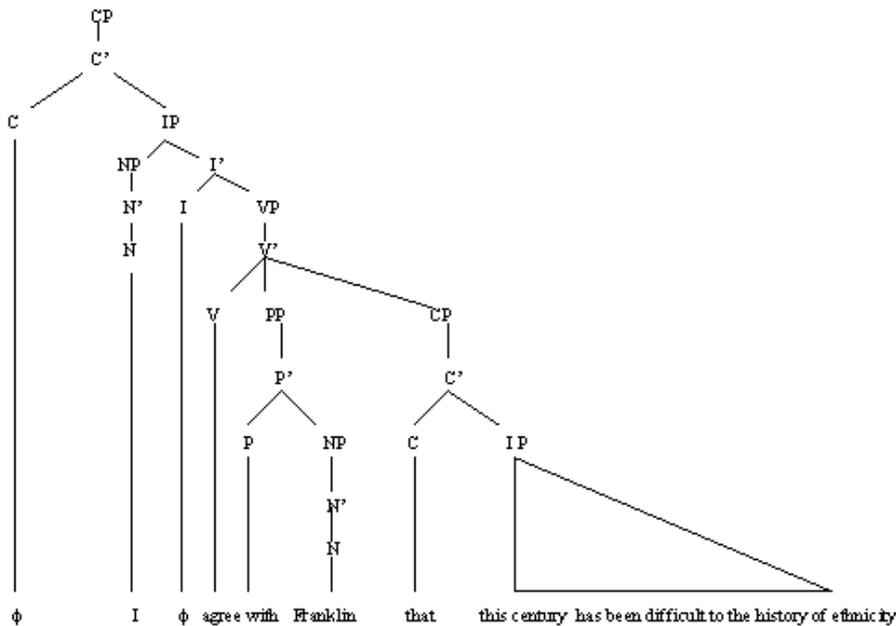
History of Ethnicity During the Last Three Centuries by Ceci 1/25/97

History of Ethnicity is a controvertial and difficult topic to talk about. It is because many lives and hard personal experiences are involved in this topic. However we do not have to avoid the past but to learn from it. In my country we have a terrible history about racism and intolerance. Many people are still so angry with "the conqueres", and they cannot understand that many generations have past and that Spanish people are not the same that five centuries ago. The Conquer of Latin America is a fact, and many indigenous people dead. Intolerance, ignorance and racism governed the minds of those people who killed many indians in America. However we cannot continue crying those facts but learning from them. I agree with Franklin that this century has been difficult to the History of Ethnicity; but I consider that we have to be optimist and to try to change this situation in this moment. History is nothing if we do not bring it to our everyday lives, and if we do not see how do those terrible experiences can be changed or how can we avoid other possible experiences that our racists, intolerants and ignorants attitudes can propiciate. Every day is a new day, a new opportunity to start again. Why do we have to wait until others decide to start a new world? We can start changing these terrible situations that manking has had.

If we think that it is not possible to do it, it won't be possible. But if we think that it is possible and we start with our personal relationships, we can change the world...

NOTES

1. I am using the terms task and activity interchangeably. Tasks are usually defined as activities that are meaning-focused and outcome-evaluated and have some sort of real-world relationship (Foster & Skehan, 1996). In this study, posting student reactions to academic readings and evaluating these student texts in terms of content and syntactic complexity constituted a task. These tasks or activities had a real-world relationship in that students were expected to develop academic writing and reading skills.

2. Writing instructors Mauricio Mendez Lopez and Marsha Rickels, who were also graduate assistants, helped identify, code, and analyze the asynchronous and synchronous data. Mauricio Mendez Lopez performed the statistical analyses on the data.

3. The T-unit is defined by Hunt (1970, 64-67) as [the] "main clause [of a sentence] plus all subordinate clauses and nonclausal structures attached to or embedded in it." For example, the following was coded as one T-unit: *"When they graduated from college, the government let them work in Beijing."* Similarly, the following example is coded as one T-unit: "*I know a little bit of Tseltal which is an indigenous dialect from the Mayan area."* The first example contains a subordinate adverbial clause (when), whereas the second example shows evidence of embeddedness (which) within a main clause. In identifying and counting clauses we included both an overt subject and a finite verb (e.g., "Glennon is from a working class family,") and nonfinite clauses such as "in order to study…" A subordinate clause usually represents the embedding of one clause within another in a hierarchical relationship. The subordinate clauses we identified were generally preceded by the following subordinating conjunctions*: After, although, because (as causation), before, if, since, so as, until, and when*. The specific types of embedded sentences which we identified were generally introduced by a *complementizer,* which is defined as a word such *as that, who, which, for* that introduces a clause (Jacobs, 1995).

4. Moffett (1968, 174) illustrates a problem concerning the validity of the T-unit as a measure of syntactic complexity in his comparison of the following pair of sentences:

   "{I don't like}{ what is left in the cup}{after you finish drinking}" (three clauses, one T-unit)

   "[I don't like the dregs] (one clause and one T-unit)Superficially, the first sentence is syntactically more complex because of the number of embedded clauses. However, the second sentence is more target like and may be an indication that this writer possesses a more elaborate vocabulary than the writer of the first sentence.

5. The following example illustrates our coding and identification of embedded subordinate clauses in this study: "[The main idea of this story is **that** you can't deny your race or ethnic group] [and [**that**] you can't show people how white or how American you are supposed to be.]" This example was coded as two T-units. There were two embedded subordinate clauses within these two T-units.

6. Foster and Skehan (1996) use clauses/c-units and syntactic variety as indicators of syntactic complexity. They define c-units as each independent utterance providing referential or pragmatic meaning (1996, 310) but never give concrete examples of either c-units or syntactic variety.

7. Intense social interaction for intermental development and functioning form part of Vygotsky's (1978) view of human learning and development. A key concept is the zone of proximal

development (ZPD) or the gap between what the learner could accomplish alone and what he or she could accomplish in cooperation with more skilled or experienced caretakers or peers.

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