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## *The Discourse of Computer-Assisted Language Learning: Toward a Context for Descriptive Research*

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Understanding how the speed, power, and flexibility of computers can facilitate second language acquisition is an intriguing challenge faced by instructors, researchers, and theorists. Progress in this area, however, does not appear to be forthcoming from current research on computer-assisted language learning (CALL), which suffers from the same limitations as early research on classroom instruction: Little detail is provided to describe the interaction among participants during instruction (Long, 1980). Moreover, descriptions of CALL activities included in reported research are not empirically based: They fail to describe what subjects actually do while working with CALL. A third problem is that the terms used to describe CALL activities have been developed specifically for that purpose, and are therefore not comparable to those used for classroom activities. At the same time, these descriptors are not sufficiently uniform and formally stated to allow specific comparisons among CALL activities. Toward a solution to these problems, this paper proposes a discourse analysis of student-computer interaction enabled by viewing the student and the computer as two participants in a dialogue. It argues that the discourse analysis system of classroom interaction developed by Sinclair and Coulthard (1975) provides the necessary elements and structures to describe CALL discourse, analyze data from student-computer interaction, and compare CALL activities with other (classroom) activities.

Computer-assisted language learning (CALL) is now used routinely in language instruction (e.g., to provide out-of-class practice in grammar and reading skills, problem solving, group work, and writing); as technical capabilities and human imaginations expand, additional uses for computers in ESL instruction will emerge. Instructors and researchers need to understand how CALL

can best be used to offer effective instruction to language students. More than other resources, CALL has the potential for individualizing instruction. Accordingly, a CALL research agenda should seek concrete results concerning successes and failures of individual students with a variety of CALL activities. Unfortunately, the lack of precision characterizing CALL research at present precludes such results. Little if any current CALL research can offer unambiguous evidence concerning effects of CALL activities because current research methods fail to elucidate exactly what students do while they work with language learning software.

Much current CALL research (e.g., Kleinmann, 1987) shares the pitfalls of investigations of second language classroom teaching methods of the 1950s and 1960s, in which performance of students in classrooms labeled, for example, *grammar-translation* was compared to students' performance in classrooms labeled, for example, *audiolingual*. (See Allwright, 1988, for a detailed description of this history.) As Long (1980), Allwright (1988), and Chaudron (1988), among others, point out, this research was inconclusive because too many factors influencing students' performance were not accounted for. One of these factors was what students and teachers actually did and said in the classrooms under investigation. To underscore the importance of describing classroom interaction, Long (1980) noted that "there is no guarantee . . . that the methods do not overlap in some respects, e.g., through their shared use of a common subset of classroom procedures. In a research context, this means that it is impossible to ascertain which subjects have received the treatment" (p. 2). Classroom research requires more than general labels for instruction; it requires precise descriptions of the interaction that occurs in classrooms. Similarly, if researchers hope to understand what and how particular students learn using CALL materials, it is necessary to characterize the interaction that takes place while they work.

This paper clarifies the need for a precise analysis of student-computer interaction in CALL research, using the principles of classroom discourse analysis developed by Sinclair and Coulthard (1975). (All subsequent references to Sinclair and Coulthard cite this 1975 description.) The paper illustrates how such an approach might be used to characterize systematically students' work on a CALL grammar lesson. This discourse analysis approach enables a description of potential and actual student-computer interaction as students work with the lesson, and provides a comparison of the grammar lesson with other activities. We begin with a summary of current approaches for describing CALL activities, noting their shortcomings.

CURRENT APPROACHES TO DESCRIBING CALL

The CALL literature abounds with schemes for describing and categorizing the computer activities used in language classes. In pedagogical terms, *program-controlled* vs. *learner-controlled* activities are dichotomized. Making this distinction, Higgins' (1988) terms "magister" (p. 12) and "pedagogue" (p. 14) provide a vivid analogy by anthropomorphizing the two types of programs. The magister is the powerful instructor in control of the students and what they learn.<sup>1</sup> The pedagogue role of the computer is that of helper; the student is in charge of learning and bears the responsibility for calling on the computer as needed.<sup>2</sup> These definitions (detailed in Figure 1) of the roles of computers in language instruction have underscored the fact that there is nothing inherent in computers to render their role in the classroom magisterial.

FIGURE 1  
Higgins' (1988) Parameters for Describing CALL

Pedagogical parameters	
<i>Magister</i>	Directs students' learning Has authority to evaluate, praise, censure Structures the order of events Explains rules; gives examples Repeats endlessly
<i>Pedagogue</i>	Assists students' learning Has no authority Provides no structure Answers students' questions Follows students' orders

The magister/pedagogue distinction, however, fails to account for linguistic aspects of computer activities, that is, the types of language that are the focus of an activity. This linguistic dimension is what Underwood's (1984) dichotomy for computer activities

<sup>1</sup> Other terms used for *program-controlled* and *magister* are "knower-of-the-answer" referring to tutoring activities (Jones & Fortescue, 1987, p. 5), "tutor" (Kenning & Kenning, 1983, pp. 2-3), and "instructor" (Wyatt, 1984, p. 6).

<sup>2</sup> Other terms consistent with *learner-controlled* and *pedagogue* are Jones and Fortescue's (1987, p. 6) "knower-of-the-answer" (when the computer is used as a discovery device), "workhorse," and "stimulus"; also Wyatt's (1984, p. 8) "facilitator" (when the computer is used for wordprocessing or data bases) or Wyatt's (1984, p. 7) "collaborator" (when the computer is used for adventure games and simulations, for example).

offers by distinguishing “communicative” ( p. 51) from noncommu-  
 nicative CALL. (Note that Underwood’s term for the opposite of  
 “communicative” software is “wrong-try-again” [p. 52] software  
 rather than “noncommunicative” as used here.) Underwood’s  
 “premises for communicative CALL” (p. 51) identify features  
 (summarized in Figure 2) he presumes communicative CALL to  
 have. Underwood’s premises are based on Krashen’s (1982) input  
 hypothesis, which assumes that comprehensible input is what is  
 needed to allow the learner to develop an acquired linguistic  
 system; explicit instruction, therefore, is of very little benefit  
 because such instruction serves only the “learned” system. Problems  
 with this account of second language acquisition are outlined by  
 McLaughlin (1987). Despite the questionable theoretical constructs  
 forming the basis for these features, they succeed in providing  
 criteria for judging whether or not a computer activity is  
 communicative. Moreover, Underwood’s criteria for communica-  
 tive CALL have helped to emphasize the importance of meaningful  
 language use in computer activities.

FIGURE 2  
 Underwood's (1984) Parameters for Describing CALL

Linguistic parameters	
<i>Noncommunicative CALL</i>	
	Program incorporates grammatical sequencing
	Program judges to inform students of their errors
	Program is in control
	Subject matter is irrelevant to student
	Lesson is predetermined
	Student perceives task as a required lesson
	Student views task as identical to classroom activities
<i>Communicative CALL</i>	
	Program does not impose grammatical sequencing
	Program judges more to provide helpful hints
	Student is in control
	Student relates to subject matter in a personal way
	Student creates own learning experience
	Student perceives task as motivating supplement
	Student views task as a novel activity

Despite the values of these general pedagogical and linguistic  
 software definitions, their lack of precision is apparent to anyone  
 who has attempted to use them to write a detailed software descrip-  
 tion. Seeking greater precision in describing CALL activities,

Phillips (1985) provides a set of descriptors integrating pedagogical and linguistic categories.<sup>3</sup> These terms (listed in Figure 3) can be used both to draw informal distinctions among kinds of software and to generate ideas concerning possibilities for developing CALL activities. Phillips' terms, such as "quiz activity," (p. 26) are designed to suggest what students might actually be doing in a computer activity, just as the name *communicative classroom*, for example, brings to mind particular classroom activities. Phillips' description of a rational-deletion cloze CALL exercise is summarized in Figure 3, using his complete set of parameters. Note that this descriptive scheme still fails to capture the actual activities of students engaged in CALL.

FIGURE 3  
Phillips' (1985) Description of a Rational-Deletion Cloze CALL Exercise

Parameter	Cloze exercise
Activity type	Quiz
Learning style	Recall, experimental learning
Learner focus	Doing a test
Program focus	Control over syntactic form
Classroom management	Individual work
Program difficulty	Little flexibility
Language difficulty	Could be a choice of levels

Results of CALL research are reported in terms similar to Phillips'. The following exemplify the type of descriptors used: "text manipulation programs" (Piper, 1986, p. 187); "simulation" (Jones, 1986, p. 179); "drill and practice," "free conversation," "problem-solving simulation" (Abraham & Liou, in press); "software packages emphasizing reading comprehension skills" (Kleinmann, 1987, p. 269); "a reading skills program which automatically provides cloze versions of texts" (Windeatt, 1986, p. 82); "drill and practice . . . grammar, reading, and listening" (Chapelle & Jamieson, 1986, p. 30). Unfortunately, these terms are as inadequate for describing activities under investigation in CALL research as are the names of classroom methods for the precision required of successful classroom research. Consequently, it is rarely

<sup>3</sup> Pedagogical approaches used in courseware have been detailed by educators for years, using such terms as *drill and practice* and *simulation* (e.g., Alessi & Trollip, 1985). The linguistic dimension has been categorized using the traditional skill areas such as reading and grammar (e.g., Wyatt, 1984; Ahmad, Corbett, Rogers, & Sussex, 1985).

clear exactly what students have done while they were working on the CALL activity under investigation. This lack of precision makes CALL research to date difficult to interpret. Three problems arise in conducting and interpreting CALL research when instructional activities are described solely by the researcher's holistic impressions.

First, descriptions based on a single view of an entire CALL activity do not account for the details of student-computer interaction. In the "quiz" activity cited above, for example, left unspecified were pedagogical features including the following: the order in which the blanks are completed, the number of opportunities given the student to complete a blank, and the help and exit options available. The unspecified linguistic details include types of deleted words, specific student errors, and the computer's assessment of and response to those errors.

A second problem with general descriptions of CALL activities is that they characterize what students can or should do while working on a computer activity, failing to describe what students actually do. Simply labeling a CALL program a "quiz activity" does not necessarily make it one. If the student uses the "quiz" to "explore the limits of the computer's 'knowledge' by devising suitable examples to test out the rules it is using" (Phillips, 1985, p. 29) rather than to try to get the correct answers on the first try so as to accumulate a high score, then that student's behavior would be inconsistent with the program's designation as a quiz. Instead, the student would be treating the quiz as an exploratory program. Similarly, with respect to linguistic strategies, if the program developer intends a cloze activity to allow students to use discourse clues (clues beyond the sentence) to develop discourse competence, yet the student consistently guesses on the basis of the immediate context (i.e., within the clause), then the developer's program description would again be inaccurate.

These two inadequacies in descriptions of CALL activities negatively affect the internal validity of CALL research because incomplete descriptions of the instructional materials under investigation preclude unambiguous results. Moreover, misconceptions concerning what subjects did during an instructional activity ensure inaccurate interpretation of results.

The third problem affects the external validity, or generalizability, of CALL research. When a CALL activity is described in terms devised and defined exclusively for that exercise, it is not clear how the exercise is similar to or different from other CALL or classroom activities. To date, descriptors have been used to establish pedagogical categories under which CALL activities can be labeled, but have not yet specified a precise language (or

formalism) for discussing different CALL activities in terms common to all CALL and classroom activities. Such general descriptions do not allow the researcher to address the following: How quiz-like is a quiz? What additional features would turn a quiz into a drill? What features does a CALL quiz share with a classroom quiz? How is a CALL quiz different? What language forms and functions does the activity require of the student? The linguistic descriptors typically used for CALL are far more structure-oriented (e.g., lexis, morphology) and skill-oriented (e.g., reading, writing) than are the functional communicative terms used by classroom researchers. (Functionally defined terms used in current research on second language classrooms are illustrated in collections by Larsen-Freeman, 1980; Day, 1986; and Fine, 1988.) For valid comparisons of the capabilities and limitations of CALL relative to classroom activities, it is necessary ultimately to describe CALL interaction using terms similar to those used by classroom researchers.

In summary, identifying the effects of CALL activities on specific learners requires precise description of the interaction (or discourse) that occurs between learner and computer. Such a description must be empirically based, and expressed in a formalism that can be used for all CALL, as well as classroom, activities. Such a descriptive formalism has been explored by classroom researchers who have recognized these problems and have been attempting their solution for the past 15 years. This paper argues that the classroom discourse analysis system of Sinclair and Coulthard provides a promising direction for empirically based, formal descriptions of CALL.

## DESCRIPTION OF CLASSROOM DISCOURSE

Researchers of language classrooms hope ultimately to understand the effects of classroom instruction by first systematically describing what teachers and students do and say in classrooms. In second language research, for example, Chaudron (1977) employed elements of the classroom discourse analysis of Sinclair and Coulthard as the basis for his description of teachers' corrective treatment of language learners' errors, using some of Sinclair and Coulthard's functional units and their sequencing rules. (See Chaudron, 1988, for a comprehensive discussion of units of analysis in second language classroom research.) Sinclair and Coulthard attempt a thorough discourse description of the kinds of acts found in classrooms and the constraints on their location in a lesson as a whole. Because of the context dependency of functional definitions of discourse units, they place discourse acts within a larger structure, thereby describing the sequencing of particular acts.



This system (simplified and adapted here), based on observation of language used in classrooms, proposes a category system consisting of analytic units related to each other in a structure called a "rank scale" (p. 20). Higher ranks are defined by the units of lower ranks they comprise. Devised to build a hierarchical description of the *acts* composing classroom lessons, the system has at its lowest rank the acts that teachers and students perform. An act might be something like the teacher's question, "Does anyone know?" That particular act, according to the linguistic rules, could be used as an initiating *move*, the next higher unit. There are several different types of moves in the original system, three of which are *initiation*, *response*, and *feedback* (also termed *follow-up*). Teachers often, but not always, initiate when they ask students questions. Students usually respond. Teachers often follow up when they comment on, evaluate, or elaborate on students' responses. When those three moves together occur in a sequence, they are further analyzed as an *exchange*. Sinclair and Coulthard defined the sequence (initiate, respond, feedback) as a particular type of exchange—a teaching exchange. At the next level then, a series of an unspecified number of teaching and other types of exchanges compose a *transaction*. A series of transactions is, in turn, analyzed as a *lesson*. (Note that although Sinclair & Coulthard's original system has been refined and expanded [e.g., Coulthard & Montgomery, 1981], its central principles remain the same [Coulthard, 1985].)

Given the comprehensiveness of this ambitious system, it is not surprising that second language classroom researchers have tended to limit their analyses to specific aspects of discourse or to linear sequential descriptions of some of the acts present in classrooms (e.g., Fanselow, 1977), rather than attempting to specify which acts can realize particular moves, which sequences of moves compose different types of exchanges, how exchanges form a transaction, and how transactions fit together in a lesson. Given the fluidity of many classroom activities, such a grammar would indeed be difficult to write. A CALL program, on the other hand, structures the domain of possible discourse between student and computer, making it possible to write a grammar that describes the interaction.

## DISCOURSE ANALYSIS OF CALL ACTIVITIES

Computer software makes possible two (though not mutually exclusive) discourse situations categorized on the basis of their participants. In the first instance, software can be used as the center of an activity that promotes conversation among human participants; the computer provides something interesting and dynamic to work on. Several researchers have examined the amount and

functions of language produced by learners in this situation (Piper, 1986; Mydlarski, 1987; Abraham & Liou, in press; Liou, 1989). Also examining communication between human participants, Esling (in press) proposes an investigation of the functional acts used in learners' e-mail (i.e., electronic mail, the written messages people exchange via networked computers at remote locations).

This paper focuses on the discourse situation that occurs when the computer provides language practice through student-computer interaction. Depending on the program, the interaction allowed can render possible a variety of functional acts. A precise description of an activity could be formulated by specifying the types of acts possible within a given CALL program, which acts can be used as each type of move, how moves fit together to form legal exchanges, and so on, until the grammar of the CALL activity is defined. This grammar, then, provides an unambiguous statement of the parameters of student-computer interaction within a CALL program. The grammar of possible discourse forms a framework for describing actual acts of the students as they work, as well as a basis for comparison with the acts allowed in other CALL and classroom activities. To demonstrate how such an analysis is done, a CALL grammar lesson is first described anecdotally, then in the pedagogical and linguistic terms reviewed above, and finally using the principles from Sinclair and Coulthard's discourse analysis system.

### Description of a CALL Grammar Lesson

The CALL grammar lesson that serves as our example is one in a series of grammar and paragraph development lessons (Chapelle & Boysen, 1990) for intermediate- to advanced-level ESL students. The purpose of the lesson is for students to review and practice the correct forms and appropriate use of the present perfect tense in contrast to the past tense in a context requiring attention to both meaning and form. The main "page" of the lesson that the student sees on the computer screen in three colors (taken from the Phrases page of Grammar Lesson 6) is illustrated in Figure 4.

The page presents three groups of phrases: adverbial time phrases, subjects, and verb-plus-complement phrases. The student must choose a phrase from each group; as each phrase is chosen, the computer plots it on the lower portion of the screen, ultimately forming a sentence. However, the verbs are in the simple form. The student must edit the verb in each sentence, supplying the form appropriate to the given context. Because students require additional (factual) information to create meaningful sentences, help is available, labeled Facts and displayed in table format (see Figure 5). Ideally, the student will consult Facts to learn about the situation,

**FIGURE 4**  
**Screen Display from Phrases Page: Present Perfect and Past Tense**

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TIME PHRASES		
→ Since the 1970s, During the prosperous 1960s, For the past several years,	In the 1960s, Before the problems began in the 1970s, Since the rise in fuel prices,	

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SUBJECTS		
car buyers	the American car industry	American cars

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VERBS AND COMPLEMENTS	
begin to want small cars. start to value fuel economy. purchase large cars. increase automation in the factory. have large engines.	become fuel efficient. cut workers' wages. use all American auto parts. produce cars with V-8 engines.

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*Move the arrow and press RETURN to select a phrase from each section.  
 Then, edit the verb to make it correct.*

<i>PF1 Words</i>	<i>PF2 Facts</i>	<i>PF3 Grammar</i>	<i>PF4 Exit</i>
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and will then be able to choose phrases that create factually true sentences, and to edit the verbs, rendering them correct and appropriate to the meaning of the sentences.

While all students are expected to need help with the facts of the lesson's topic (the U.S. automobile industry), some students will also require definitions of certain words in the phrases, as well as a review of the verb forms and their uses. To receive help with words, students press PF1 (as indicated on the bottom of the screen); they are asked, "Which word?" They type the word, and the program returns its definition. To receive help with the verbs (PF3), students are offered two types of grammar help: They can look at several pages summarizing the grammar rules and forms for the present perfect and past tenses, or they can go through a step-by-step tutorial on how to form and edit the sentences in the exercise. All of the help—facts, words, and grammar—is optional; if students do not request to see these parts of the program, they never will. Instead, they can work on the exercise simply by forming and editing sentences, reading the computer's evaluation of the sentences, and saving those they wish to print.

The computer evaluates and returns detailed feedback messages

FIGURE 5  
Screen Display from Facts Page: Present Perfect and Past Tense

FACTS ABOUT THE PAST AND EVENTS THAT BEGAN IN THE PAST		
WHO/WHAT?	DID WHAT?	
	WHEN? in the 1960s	WHEN? until today
Car buyers	Purchase large cars	Want small cars Value fuel economy
Car industry	Use American auto parts Produce V-8 engines	Cut workers' wages Use factory automation
American cars	Have large engines	Become fuel efficient

(as illustrated in Figure 6) for every sentence that the student forms. When a sentence is incorrect, there are two possible problems: its meaning or its verb form. The meaning errors can be further subdivided into two types: those that create nonsense sentences, and those that create sentences that are not true according to the facts. Verb errors can also be subdivided into two: those in which the wrong tense or number is used given the subject and meaning of

FIGURE 6  
Example Student Sentences and Computer Feedback

Student's sentence	Computer's message
<i>Meaning errors</i>	
Since the 1970s, car buyers have increased automation in the factory.	That doesn't make sense because of the subject and verb. <i>Car buyers can't increase automation in the factory.</i>
During the prosperous 1960s, American cars became fuel efficient.	That's not true. <i>During the prosperous 1960s</i> means PAST and that event continues today.
<i>Verb errors</i>	
Before the problems began in the 1970s, car buyers have purchased large cars.	You must use the past tense ( <i>purchased</i> ) for this event in the past.
Since the 1970s, the American car industry has increase automation in the factories.	You must use the <i>increased</i> form after <i>has</i> .
<i>Correct</i>	
In the 1960s, American cars had large engines.	The verb is correct in that sentence.

the sentence, and those in which the verb is incorrectly formed according to the rules of English.

It is possible to describe this lesson using the parameters developed by Higgins (1988), Underwood (1984), and Phillips (1985). Figure 7 presents an interpretation of the parameters delineated under the magister/pedagogue and the communicative/noncommunicative distinctions.

FIGURE 7  
The Grammar Lesson Described in Terms of  
Higgins' (1988) and Underwood's (1984) Parameters

Parameter	Application to the grammar lesson
<b>Pedagogical parameters</b>	
<i>Magister</i>	
Program directs students' learning	No
Program has authority to evaluate, praise, censure	Yes
Program structures the order of events	No?
Program explains rules; gives examples	Yes
Program repeats endlessly	No
<i>Pedagogue</i>	
Program assists students' learning	Yes
Program has no authority	No
Program provides no structure	No?
Program answers students' questions	Yes?
Program follows students' orders	Yes
<b>Linguistic parameters</b>	
<i>Noncommunicative CALL</i>	
Program incorporates grammatical sequencing	No
Program judges to inform students of their errors	Yes
Program is in control	No
Subject matter is irrelevant to student	?
Lesson is predetermined	No?
Student perceives task as a required lesson	?
Student views task as identical to classroom activities	No?
<i>Communicative CALL</i>	
Program does not impose grammatical sequencing	Yes
Program judges more to provide helpful hints	Yes
Student is in control	Yes
Student relates to subject matter in a personal way	?
Student creates own learning experience	Yes?
Student perceives task as motivating supplement	?
Student views task as a novel activity	Yes?

*Note.* ? indicates uncertainty of the value given or inability to assign a value because the parameter is too general or a matter of the student's opinion.

Overall, the lesson appears more pedagogue than magister and more communicative than not. The judgments one might make on the basis of Phillips' descriptors are represented in Figure 8. All of these descriptions, however, are based on a single rater's fallible judgment of the overall activity. In other words, these descriptors do not recommend themselves as criteria for a reliable, detailed view of a CALL activity.

**FIGURE 8**  
**Phillips' Description of a Rational-Deletion Cloze CALL Exercise**  
**and Description of the Grammar Lesson Using Phillips' (1985) Parameters**

Parameter	Cloze exercise	Grammar lesson
Activity type	Quiz	Exploratory?
Learning style	Recall	Recall, comprehension, experimental learning
Learner focus	Doing a test	Trying out sentences
Program focus	Control over syntactic form	Control over meaningful and grammatical sentences
Classroom management	Individual work	Individual work
Program difficulty	Little flexibility	Flexibility only in help options
Language difficulty	Could be a choice of levels	No flexibility, but help available

*Note.* ? indicates uncertainty of the value given or inability to assign a value because the parameter is too general or a matter of the student's opinion.

## Discourse Analysis of the Grammar Lesson

The problem of the unreliable and general character of these CALL descriptions may be solved by adapting the units of analysis and structures suggested by Sinclair and Coulthard for classroom discourse. At the lowest level of this ranked scale, the functional acts that the computer can perform are the following (listed in Figure 9): offer help (facts, words, grammar); offer a phrase; offer to let the student exit; require the student to edit; offer to save a sentence; exit from the transaction; save a sentence; provide help; add a phrase to a sentence; and judge a sentence. The student can perform the following acts: choose help, choose to exit, select a phrase, edit a phrase, and choose to save a sentence. The structure of these acts becomes apparent when each is assigned to a particular type of

move, which has a defined place in an exchange. According to the rules of this CALL activity, a move can be realized by only one act. The possible moves and acts that can realize them are detailed in Figure 9. As an example, the initiating move should be read as follows: The computer can perform an initiating move that can be realized as offering help; offering to let the student exit; offering a phrase; requiring the student to edit; or offering to save a sentence.

FIGURE 9  
The Grammar Lesson: Participants, Moves, and Acts

Participant	Move	Acts
Computer	Initiate	Offer help, offer exit, offer phrase, require edit, offer save sentence
Computer	Obey	Exit, save sentence
Computer	Follow up	Add phrase, judge, provide help
Student	Choose	Choose help, choose exit, choose save sentence
Student	Respond	Select phrase, edit

The structure of interaction is defined by the grammar of this discourse analysis system: In this lesson, these moves fit together in triplets called *exchanges*. There are three types of exchanges (see Figure 10) allowed in this lesson: teaching, focusing, and framing. A *teaching* exchange begins with the computer initiating, or asking for, a response. Next, the student responds—either selecting a phrase, or editing a phrase. Then, the computer follows up—either adding a phrase to the sentence, or judging the student’s sentence. All of the acts in the teaching exchange are directly related to the instructional task at hand, rather than to the management of the program or to gaining additional information. A *focusing* exchange, on the other hand, is used to provide students with additional help. It also begins with an initiating move (made by the computer). The initiating move is followed by the student’s choice for help (facts, words, or grammar). The follow-up move is realized by the computer providing the corresponding help. A *framing* exchange is used for program management: saving sentences and ending a transaction. It, like the others, begins with the computer’s initiating move, which offers an option. The choice made by the student is to

save the sentence or to exit. The computer obeys by saving the sentence or exiting from the transaction, then beginning the next one.

FIGURE 10  
The Grammar Lesson: Exchanges and Moves

Exchange	Moves (in the order indicated)
Teaching	Initiate, respond, follow up
Focusing	Initiate, choose, follow up
Framing	Initiate, choose, obey

In Sinclair and Coulthard's classroom description, the teaching and framing exchanges are similar to the ones described for the grammar lesson. The teaching exchange is used for teachers' questions, students' responses, and teachers' evaluations. The framing exchange is usually used to mark the boundaries of transactions. However, the focus exchange is usually "a metastatement about the transaction" (Coulthard, 1985, p. 123), a definition that necessitates the instructor's control over the transaction. The focus exchange in the grammar lesson, in contrast, is under the control of the student, who will choose to focus on one or more aspects of help during a transaction.

In Sinclair and Coulthard's system, a transaction is defined as a sequence of exchanges. Transactions within the student-computer interaction can be defined in terms of particular obligatory and optional exchanges, as indicated by this example that describes the grammar lesson:

(FOCUS)\* TEACH (FOCUS)\* TEACH (FOCUS)\* TEACH TEACH  
((FRAME)\* (TEACH)\*)\* FRAME

The parentheses indicate optional exchanges; the asterisk denotes an unlimited number of an exchange type. The grammar of this example reads as follows: A transaction consists of an optional, unlimited number of focusing exchanges, followed by an obligatory teaching exchange, followed by an optional, unlimited sequence of focusing exchanges, followed by a teaching exchange, followed by an optional, unlimited number of focusing exchanges, followed by two obligatory teaching exchanges, followed by any of these three possibilities: (a) an optional, unlimited number of framing exchanges; (b) an optional, unlimited number of teaching exchanges; or (c) an optional, unlimited number of framing and



teaching pairs. The transaction must be terminated by a framing exchange. These transactions, unordered and of unlimited number, form a lesson, noted as follows:

#### TRANSACTION (TRANSACTION)\*

This discourse analysis system defines the specific acts that can occur and the structure of discourse in which they can occur in CALL activities. In doing so, it provides a level of detail that is much more precise than terms such as *learner-controlled* and *exploratory*. These two terms can be more precisely defined by specifying (a) the number and functions of the acts performed by the student and computer (in the case of the grammar lesson as defined in Figure 9, there are 5 for students, and 10 for the computer); (b) the functions of the computer's follow-up moves (add phrases, judge sentences, and give help); (c) the ratio of optional-to-obligatory exchanges in a transaction (1-to-1); (d) the number of obligatory and optional transactions in a lesson (1 obligatory and unlimited optional); and (e) the order of the transactions in a lesson (no order). (Note that the simple notation introduced here is not adequate for expressing ordered transactions.) Despite the objective detail of this analysis, for reporting research on students' CALL use, it alone has little validity because it describes only what students can do while they work on the grammar lesson; it fails to report what students actually did.

#### Discourse Analysis of Student Data

An empirically based description can be constructed using the structure of possible discourse as a framework for plotting what students actually did while they were working on the lesson. Of course, because some exchanges are obligatory, their acts must be performed by any student who completes the activity; however, many exchanges are optional, as is the number of transactions in this lesson. Consequently, in reporting research based on this activity, essential to the description of the materials will be the quantity and quality of acts that subjects actually performed. The efficacy of this approach is illustrated by data from three subjects in a pilot group who worked on this grammar lesson. This information was obtained from each student's on-line file, which automatically stores information about what students are doing while they are working on the CALL materials. A protocol of Student A's interaction is presented (in Figure 11) to demonstrate the kind of discourse that took place. The student began by choosing phrases composing the sentence, "Since the 1970s, car buyers begin to want new cars." This

**FIGURE 11**  
**Protocol Data from Student A: Choices, Editing, and Feedback**

Participant	Action	Choices, editing, feedback
Student	Choose	Since the 1970s, car buyers begin to want new cars.
Student	Edit	begin → began
Computer	Judge	You need the present perfect (with <i>have</i> ) for this event because it happened in the past and continues now.
Student	Edit again	began → have began
Computer	Judge again	Use the <i>begun</i> form after <i>have</i> .
Student	Edit again	have began → have begun
Computer	Judge again	The verb is correct in that sentence.
Student	Choose	During the prosperous 1960s, car buyers purchase large cars.
Student	Edit	purchase → purchased
Computer	Judge	The verb is correct in that sentence.
Student	Choose	For the past several years, car buyers begin to want small cars.
Student	Edit	begin → began
Computer	Judge	You need the present perfect (with <i>have</i> ) for this event because it happened in the past and continues now.
Student	Edit again	began → have begun
Computer	Judge	The verb is correct in that sentence.
Student	Choose	In the 1960s, car buyers begin to want small cars.
Student	Edit	begin → begin
Computer	Judge	[Student chose not to edit.] That's not true. <i>In the 1960s</i> means past and that event continues today.
Student	Edit	begin → began
Computer	Judge	That's not true. <i>In the 1960s</i> means past and that event continues today.
<i>(Student tries two more verb forms, receives the same message each time, then exits.)</i>		

student then edited the verb as shown; he changed it to “began.” The verb tense was incorrect, given the meaning of the sentence; the computer therefore responded: “You need the present perfect (with *have*) for this event because it happened in the past and continues now.” The student reedited the verb twice, then continued, as indicated in Figure 11.

The data obtained from Student A’s work on the lesson, as well as the data from two other students (Figure 12) illustrates how their work can be concisely expressed. Not surprisingly, it is apparent that the three students took different approaches to the task. Only Student B selected a help option. Student A quit after creating a

FIGURE 12  
Example Data from Students A, B, and C

KEY	
<i>EXCHANGES</i>	
(FOCUS)*	= Optional, unlimited focusing exchange composed of initiating, choosing, and follow-up moves
TEACH	= Obligatory teaching exchange composed of initiating, responding, and follow-up moves
FRAME	= Obligatory framing exchange composed of initiating, choosing, and obeying moves
<i>MOVES</i>	
+	= Neutral move made by the student or computer (neither correct nor incorrect, nor was it judged so by the computer)
C	= Correct response or follow-up indicating correctness
X	= Grammatical error in a response or a follow-up indicating a grammatical error
M	= Meaning error in a response or a follow-up indicating a meaning error
G	= Choice of grammar help
Student A <sup>a</sup>	
(FOCUS)*TEACH (FOCUS)*TEACH (FOCUS)*TEACH TEACH (TEACH)(TEACH)(TEACH)*FRAME	
+++                   +++                   + C+   +XX   +XX   +CC                   +++	
(FOCUS)*TEACH (FOCUS)*TEACH (FOCUS)*TEACH TEACH (TEACH)(TEACH)(TEACH)*FRAME	
+++                   +++                   + C+   +CC                   +++	
(FOCUS)*TEACH (FOCUS)*TEACH (FOCUS)*TEACH TEACH (TEACH)(TEACH)(TEACH)*FRAME	
+++                   +++                   + C+   +XX   +CC                   +++	
(FOCUS)*TEACH (FOCUS)*TEACH (FOCUS)*TEACH TEACH (TEACH)(TEACH)(TEACH)*FRAME	
+++                   +++                   + M+   ++M   ++M   ++M   ++M                   +++	

*Note.* Parentheses indicate optional exchanges; asterisks denote an unlimited number of exchange types.

<sup>a</sup> Corresponds to protocol data in Figure 11.

FIGURE 12 (*Continued*)  
Example Data from Students A, B, and C

<b>Student B</b>						
(FOCUS)*TEACH	(FOCUS)*TEACH	(FOCUS)*TEACH	TEACH	(TEACH)(TEACH)(TEACH)*FRAME		
+++	+++	+ C +	+ X X	+ C C	+++	
(FOCUS)*TEACH	(FOCUS)*TEACH	(FOCUS)*TEACH	TEACH	(TEACH)(TEACH)(TEACH)*FRAME		
+++	+++	+ C +	+ C C		+++	
(FOCUS)*TEACH	(FOCUS)*TEACH	(FOCUS)*TEACH	TEACH	(TEACH)(TEACH)(TEACH)*FRAME		
+++	+++	+ M +	++ M	++ M ++ M	+++	
(FOCUS)*TEACH	(FOCUS)*TEACH	(FOCUS)*TEACH	TEACH	(TEACH)(TEACH)(TEACH)*FRAME		
+++	+++	+ C +	+ X X	+ C C	+++	
(FOCUS)*TEACH	(FOCUS)*TEACH	(FOCUS)*TEACH	TEACH	(TEACH)(TEACH)(TEACH)*FRAME		
+ G G					+++	
<b>Student C</b>						
(FOCUS)*TEACH	(FOCUS)*TEACH	(FOCUS)*TEACH	TEACH	(TEACH)(TEACH)(TEACH)*FRAME		
+++	+++	+ C +	+ X X	+ C C	+++	
(FOCUS)*TEACH	(FOCUS)*TEACH	(FOCUS)*TEACH	TEACH	(TEACH)(TEACH)(TEACH)*FRAME		
+++	+++	+ M +	++ M	++ M	+++	
(FOCUS)*TEACH	(FOCUS)*TEACH	(FOCUS)*TEACH	TEACH	(TEACH)(TEACH)(TEACH)*FRAME		
+++	+++	+ C +	+ X X	+ C C	+++	
(FOCUS)*TEACH	(FOCUS)*TEACH	(FOCUS)*TEACH	TEACH	(TEACH)(TEACH)(TEACH)*FRAME		
+++	+++	+ M +	++ M	++ M	+++	
(FOCUS)*TEACH	(FOCUS)*TEACH	(FOCUS)*TEACH	TEACH	(TEACH)(TEACH)(TEACH)*FRAME		
+++	+++	+ C +	+ C C		+++	

sentence whose meaning was incorrect without trying to correct it or form another sentence. Student C, on the other hand, did not quit until having a sentence judged correct. The data also exhibit some similarities. None of the students chose help immediately after making errors. Student B used help once, but then exited immediately thereafter. They all appear to have been attempting correct answers with each of their responding moves; whenever they received a grammar error message from the computer, they kept working on the sentence until they got it correct.

This summary of data permits an accurate, detailed description of how students work with the lesson. More detail could be added to this summary of data: One could, for example, indicate which phrases were chosen by numbering each phrase and recording those chosen in the students' profiles. Even with the small amount of data

illustrated here, we can now begin to address the question: Do these data support the general descriptions of the lesson such as those developed using the parameters of Higgins (1988) and Phillips (1985)? For example, was it accurate to label this primarily a learner-controlled (pedagogue), exploratory activity? From the limited data examined, the three learners did use some different acts, to form somewhat different structures of interaction—structures that they themselves controlled. Yet, the number of transactions is similar for all three subjects. What does learner-controlled mean if all learners choose to use the software in a similar fashion? Grammatically speaking, these three subjects did not appear to explore the verb tenses. After a single instance of creating a correct verb form, they exited from the transaction and began another. This is contrary to what one would expect of students who were using the exercise as an exploratory activity. This analysis suggests that it may not be appropriate to term software exploratory; rather, it seems that *exploratory* as a term must refer to the behavior of the students.

#### COMPARING CALL ACTIVITIES TO OTHER INSTRUCTIONAL ACTIVITIES: A FUTURE RESEARCH AGENDA

In looking at the actual data from the “exploratory” program, one might wonder if they define the limits of student exploration with CALL. To answer this question, it would be necessary to examine data from a larger number of subjects working with this software, as well as to compare the actual data from the subjects who worked on this activity with data obtained from students working on other CALL activities. The concepts adapted from Sinclair and Coulthard, along with the notation introduced here, comprise the foundation of the formal system needed to make such comparisons. It is a formal system because it has a syntax (e.g., exchanges are composed of moves; moves are composed of acts) and a semantics (acts are interpreted as particular, real-world phenomena) of its own. Within the rules of the system, elements can be expanded and rearranged to express the variety of student-computer interactions that may take place. Expression of different activities using the same formalism is a necessary first step in making comparisons, as noted by discourse analysts (Coulthard, Montgomery, & Brazil, 1981) using Sinclair and Coulthard’s principles:

We develop new descriptions for each situation using the same descriptive principles. Thus we were engaged in describing what it is that makes TV discussions, for example, different as speech events from

doctor/patient interviews and committee meetings, but of course for a set of such descriptions to be mutually enlightening they would need to have more or less common modes of description. (p. 15)

That common mode of description is also what is needed for expressing student-computer interaction.

In comparing one computer activity to another, then, it is necessary to identify the functional acts the activity allows, and the structure of those acts. For example, in the cloze exercise summarized using Phillips' (1985) descriptors in Figure 3, we might use this discourse analysis system to delineate what functional acts are allowed, which moves they realize, how those moves form exchanges, and what the optional and obligatory exchanges are in a transaction. If the cloze activity were expressed using the same formal system as the grammar lesson, their possible discourses could be compared, and researchers reporting results based on the two activities could use one set of expressions to summarize actual acts performed by subjects using both activities. Of course, more acts will need to be introduced to describe other CALL activities. This paper is intended to illustrate these principles rather than to propose the set of necessary acts to account for CALL activities.

However, one might ask if it is necessary to use the complex system devised for human interaction to express and compare the limited discourse of CALL activities. Indeed, current pedagogical and linguistic descriptors for CALL are presented as unique from other language classroom activities. However, to isolate the constraints a CALL activity places on discourse in contrast to other language learning activities, it is necessary to use terminology comparable to what may be used for classroom discourse. For example, we note that the moves a student could perform in the grammar lesson were choosing and responding (each realized as the acts listed in Figure 9). We will require a shared formalism to answer the following types of questions: How do the quality and quantity of these moves (and the acts that can realize them) compare to those a student can perform in various classroom activities? How do the types of judging acts (feedback messages about meaning and grammar) used as the computer's follow-up moves compare to the acts Chaudron (1977) observed language teachers using as follow-up moves in classes? How do the task-defined variations on the initiation-response-feedback classroom exchange described by Heap (1988) compare to their counterparts in a CALL activity?

Unfortunately, as noted above, the structure of classroom discourse in language classroom research is typically not as clearly stated as in Chaudron's (1977) analysis. However, attempts to synthesize this research (Chaudron, 1988) have clarified the problem of

disparity among research methods, thereby encouraging future choices of discourse categories with an eye toward linguistic comparisons. A future agenda for language classroom research may work toward a standard formalism for describing and comparing activities with one another in terms comparable to Sinclair and Coulthard's. Until that time, however, the generalizability of CALL research results can be clarified by using this standard formalism to describe the specifics of students' actual interaction with the computer. Such a discussion accompanying results of learning outcomes or attitudes of particular students will offer the detail necessary for assessing the relevance of research results in one study to the expectations for CALL activities in another situation.

## CONCLUSION

The primary focus here has been the analysis of discourse units and their structures in CALL activities in order to improve the internal and external validity of CALL research, thereby strengthening our understanding and, ultimately, the classroom use of CALL. In fact, second language researchers as well as CALL theorists and developers will find such an analysis useful for other purposes.

Second language researchers attempting to assess the effects of a teaching method that remains constant for all students might offer students instruction using a formally described CALL program. The need for such consistency is exemplified by descriptive studies (e.g., Chaudron, 1977; Allwright, 1975) documenting the inconsistency of teachers' treatment of errors. This spontaneity, although obviously an asset in many ways, renders difficult the controlled study of the relative benefits of specific aspects of instruction (acts or moves) of theoretical interest. A computer program, on the other hand, maintains the necessary consistency. Robinson and Others [sic] (1986) exploited this capability, using a CALL program to test, among other hypotheses, Krashen's (1982) theory concerning implicit error correction. However, without a precise and definable formalism, the report of results fails to detail the actual student-computer interaction; moreover, missing from such research is a clear specification of the relationship between media-supported instructional treatments and their regular classroom counterparts. With an overall discourse framework using terminology common to both contexts, it may be possible to reinvestigate the use of the computer for such treatment experiments.

Additionally, second language researchers investigating students' language learning strategies may be interested in the acts that

students perform while they are working on various activities. Individual or combinations of acts can be used as reliable definitions of language learning strategies. An obvious strategy used by some students working on the grammar lesson when they opted for a *choose help* act was *resourcing*—the use of target language reference materials (as defined by O'Malley, Chamot, Stewner-Manzanares, Kupper, & Russo, 1985). Other strategies that may be defined through the use of combinations of acts in the grammar lesson are *planning* (indicated by relationships among *choose phrase* acts), *monitoring* (displayed by the consistent use of editing acts rather than reliance on the computer's judging acts for corrections), and *practice* (evidenced by the number of transactions completed). Some strategies have been assessed successfully through the use of computer-collected data from CALL programs (Jamieson & Chapelle, 1987; Mizuno, 1989); however, such results will be more comprehensible and generalizable if definitions of investigated strategies are phrased in terms of students' acts performed within a defined domain of possible discourse.

Examination of variation in students' acts within the framework of defined contexts (types of exchanges, transactions, and lessons) holds a key to long-awaited progress in research on the relationship between types of instruction and particular student characteristics. Skehan (1989) notes that surprisingly little work has been done in this essential element of a theory of second language acquisition. Indeed, CALL lessons have been used as a means for presenting material to students in a defined manner to observe outcomes for different types of learners (e.g., Abraham, 1985); however, to interpret and generalize results, so that future research can build on current findings, it is necessary to express instructional treatments in precise, empirically based, formal terms.


CALL theorists and developers are also in need of precision and consistency in their terminology. Discussion of types of CALL can proceed with maximum clarity if specific terms for CALL interaction are used. The general terms *learner-controlled* and *exploratory* for the present perfect lesson were restated more precisely and objectively in terms of discourse units and structures. Discussion of other general terms of interest such as *intelligent programs* would be clarified by an objective definition as well—a definition based on the number and quality of the acts that realize the computer's follow-up moves, perhaps. Such a definition would provide a concrete basis for exploring development of intelligent programs and for observing learners' use of aspects of a program's "intelligence."

Use of the same principles for student-computer interaction as for



human interaction applies insights from linguistic research, thereby opening a novel perspective on unsolved human-factors issues in CALL. Anyone who has witnessed first-time computer users notes the halting flow of the interaction as they turn to the instructor to ask, "What should I do now?" rather than reading the instructions on the screen. Culley, Mulford, and Milbury-Steen (1986) cite protocol data from students working on an activity similar to a CALL adventure game. The developers intended to have students enter commands to the computer, telling the program to take them to the front hall, open the letter, etc. Students had trouble understanding their role in the dialogue. These and other observations can be viewed more clearly from the perspective of linguists who note elements of human conversations that facilitate smooth exchanges (Sacks, Schegloff, & Jefferson, 1974). In light of such factors, computer software can be assessed and improved in terms of its performance as a participant in a conversation.

To maximize the utility of the CALL discourse analysis presented here, it will ultimately be necessary to add several dimensions. First, for a clear perspective on the quality of functional acts allowed, acts should be categorized in terms such as Halliday's (1977) *ideational*, *interpersonal*, and *textual* functions; Brown and Yule's (1983) *transactional* versus *interactional* functions; and other terms that may be significant for second language acquisition research. A second dimension to be added is greater specificity of the acts and their sequencing. For example, in the grammar lesson, there are particular combinations of *choose phrase* and *edit verb* acts that precede particular *judge* acts. An important part of the empirical description will be to note which of those choosing, editing, and judging acts are actually used by students. Finally, the analysis of the units and their structure leave much room for addition of contextual-pragmatic considerations (cf. Halliday & Hasan, 1989). The functions and structure presented here do not represent a comprehensive system, equipped to analyze all relevant aspects of CALL activities; instead, they provide a first step toward focusing a research agenda that promises to support progress in second language acquisition research and research in CALL.



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