CALL IN THE YEAR 2000: STILL IN SEARCH OF RESEARCH PARADIGMS?

Carol A. Chapelle

Iowa State University

ABSTRACT

Advancements in the design and use of computer-assisted language learning (CALL) activities require that key questions about CALL be identified and effective research methods be used to answer them. In this paper, I suggest looking to research on other types of second language (L2) classroom learning activities for guidance in framing CALL research questions and in discovering relevant research methods. I begin with examples from the CALL literature demonstrating the diverse perspectives (e.g., cognitive psychology, constructivism, psycholinguistics) which have been suggested as ways of approaching CALL research. I then summarize the research questions and methods of L2 classroom research with emphasis on the "interactionist" approach and discourse analysis. Using three examples --computer-mediated communication, a microworld, and vocabulary in reading-- I will illustrate how similar discourse analysis methods can address essential descriptive and evaluative questions about CALL activities. Finally, I will outline some implications of this perspective for design and investigation of CALL activities.

A glance through the computer-assisted language learning (CALL) literature of the 1990s reveals the profession's quest for principled means of designing and evaluating CALL. Like researchers in other facets of applied linguistics, CALL researchers look to cross-disciplinary sources for perspectives and research methods. A recent example of the breadth of this quest is an article entitled "A theoretical foundation for the development of pedagogical tasks in computer mediated communication," in which the author seeks to "address the pedagogical merits [for second language teaching] of this new medium of communication in relation to current research in Anthropology, Cognitive Psychology, Communication Theory, Linguistics, and Second Language Acquisition (SLA)" (Salaberry, 1996, p. 6). Similarly, in the commentary on a recent collection of papers about intelligent tutoring systems for foreign language learning, the authors draw their comments from perspectives in learning theory, psycholinguistics, human-computer interaction, psychology (MacWhinney, 1995), "a computationally oriented theory of language use" (Bailin, 1995), psycholinguistic theory (Garrett, 1995), theory of novice vs. expert learning, constructivism, and individual differences theory (Oxford, 1995).

These diverse perspectives are directed at general questions of how CALL research can increase our understanding of CALL activities. At the same time, there is a need to specify the particularly relevant questions about CALL and to identify ways that they can be investigated through empirical research. In this paper, I suggest that our understanding of CALL would benefit from addressing questions similar to those posed about other L2 classroom learning and from applying the methods used to study L2 learning in other types of classroom activities. I will begin with some examples from the CALL literature which demonstrate the need to look to empirical research methods for investigating instructed SLA. I will then turn to a brief explanation of the research questions and methods of L2 classroom research with emphasis on discourse analysis methods for investigating learners use of L2 tasks. Illustrations are provided of how analogous research questions can be posed for CALL activities and how similar discourse analysis methods can help to investigate CALL use. Finally, I note examples of how classroom research perspectives might inform CALL design.

THE NEED FOR EMPIRAL RESEARCH METHODS FOR CALL

Because CALL practice draws on cross-disciplinary work, CALL researchers and developers find themselves at the crossroads among disciplines that appear to offer insights for work in CALL. For example, it is evident from the following report of an intelligent tutoring system (ITS) project that some CALL developers see computational linguistics as a foundation for CALL:

> A rational way to begin research and development into such an ITS would be to start from first principles. The problem, then, lies in deciding which theories of language and pedagogy may prove useful to us. We shall begin with a brief survey of NLP [natural language processing] techniques/theories that form the foundation of our system (Wilks & Farwell, 1992, p. 263).

Another project description suggests that along with the computational linguist, the instructional designer comes into play in CALL design:

> One key to building robust dialog and animation exercises appears to be predicting and controlling the likely variation in what students will say. This calls for negotiation between an instructional designer, on the one hand, and a computational linguist on the other (Holland, 1995, p. 231).

Holland goes on to say that the success of the predicting and controlling must be assessed "via user testing," which means observation of the learners' interaction with the program, but it is not clear how "user testing" would be informed by SLA research.

SLA does come into play in Holland's scheme insofar as it is represented by "communicative language theory." When it comes to issues of language teaching and learning,

> the instructional designers and language teacher are concerned with effectiveness of instruction, usability of interface, authenticity of lesson content and what we might call 'pedagogical correctness,' such as adhering to the tenets of communicative language theory, if that is the guiding philosophy (Holland, 1995, p. 233).

However, the author's understanding of "communicative language theory" is not explained; nor are its implications for investigating CALL's effectiveness.

A book published in 1995 on intelligent tutoring systems for foreign language displays the same fragile foundation for the many otherwise ambitious and interesting projects reported. The editors describe the problem as follows:

> This book bears out Oxford's claim (Oxford, 1995) that few ICALL [intelligent computer-assisted language learning] projects attend to theories of how people learn or how they might learn best. Many systems are designed solely or partly by computational linguists whose focus is NLP, not the psychology of the learner. How that psychology should be addressed--and whether a priori, empirically, or through some interaction--remains the interesting issue (Holland, Kaplan, & Sams, 1995, p. 314).

Even in pointing to the problem, the editors do not allude to a solution involving work in SLA.

Why is there such a dissonance between even the most technically sophisticated work in CALL and SLA research? One reason appears to be a lack of confidence in what SLA research can reasonably be expected to offer. For example, several years ago the report of a large scale CALL research project was introduced as follows:

> There is no doubt that the evaluation of what has been called 'language teaching' necessitates a theoretical framework, a theory of foreign language learning, which has to supply the criteria for the evaluative process. As we all know, such a theory does not exist yet and probably neverwill. In research on second language acquisition and foreign language learning, however, a number of general principles have emerged which seem to be accepted by most L2 researchers (cf. 9, 13, 2 [from the same volume]). It seems legitimate to adduce these principles for assessing language teaching materials and the role of the microcomputer as a focal point in classroom activities (Legenhausen & Wolff, 1992, pp. 10-11).

These researchers did in fact develop methods for describing CALL use, arguing that such research could either take the perspective of the learner as communicator or the learner as manipulator. When they investigated the "learner as communicator" they adopted discourse analysis methods similar to those of L2 classroom researchers.

Several years later, however, another author similarly argues in a review article that CALL research suffers from our lack of knowledge about SLA:

> The greatest obstacle to the assessment of CALL's efficacy is that (still) 'we know rather little [about SLA], and a great deal of what we do know derives not only from psychologists, but also from various sub-branches of linguistics (Bailin, 1988)' (Liddell, 1994, p.164)... In the final analysis, therefore, achieving effective use of CALL to foster linguistic competence or, ultimately, the development of an acceptable SLA theory, are [sic] dependent upon the ability of researchers to understand how the mind processes information, specifically, a second language (pp. 166-167).

Despite these implications that informative research on CALL must wait for a completely articulated theory of language teaching or psycholinguistic processing model of a second language, it is clear that the need exists for perspectives and research methods that can guide in the development and evaluation of CALL activities today.

The editorial comments in a recent issue of *CALL Journal* are among the places where one can find a statement of the urgent need for better research methods for CALL.

> Validation and evaluation are extremely important aspects of any project and researchers should remember that if their papers are going to carry any weight, their findings have to be substantiated with the support of usage and validation. A number of submissions to this journal have been brilliant in their conception but have had to be returned because...the project had been poorly evaluated (Cameron, 1995, p. 294)

Indeed the needed methods of evaluation might be informed to some extent by computational linguistics, instructional design, communicative language theory, a theory of teaching, or a psycholinguistic processing theory. And yet, each of these areas falls short of providing the concrete principles needed to investigate CALL for instructed SLA. The point MacWhinney made about borrowing CALL principles from experimental psychology is equally apt for each field suggested above: "few of [its] principles speak directly to foreign language instruction and computational aids for language learning" (1995, p. 318).

What is needed then is a perspective on CALL which provides appropriate empirical research methods for investigating the critical questions about how CALL can be used to improve instructed SLA.

EMPIRICAL RESEARCH METHODS FOR INSTRUCTED SLA

Some empirical research methods for instructed SLA have evolved from the L2 classroom research of the 1980s which investigated classroom processes (Long, 1980) largely through documentation and analysis of the language used by participants in the classroom (Allwright, 1988; Allwright & Bailey, 1991; Chaudron, 1988; Day, 1986; Gass & Madden, 1985; Van Lier, 1988). Without denying the importance of linguistic outcomes, L2 classroom researchers placed greater emphasis on the type and amount of target language use that learners engaged in to provide evidence for the quality of classroom instruction. L2 classroom researchers found the most revealing way of documenting the processes occurring in an L2 classroom to be description of the language, or discourse, of the participants. As a result, discourse analysis has become a mainstay as a means for teachers and researchers to investigate L2 classrooms to the point that professional wisdom about teaching is often couched in discourse analytic terms, as the following adages illustrate: Time spent on learner talk is better than time spent on teacher talk; learners should have the opportunity to comprehend a variety of functions in the target language; learners should engage in communicative exchanges in the target language.

Research describing L2 classroom language developed collaterally with theory hypothesizing the ideal target language episodes for SLA. Beginning with Hatch's (1978) observation that language appears to be learned through conversation, Krashen's (1982) hypothesis about the value of "comprehensible input," and Long's (1985) research demonstrating the importance of interaction, researchers have attempted to better understand the input and conversational interaction that learners are exposed to during L2 instruction. The goal is to identify conditions under which ideal input and interactions take place. The theoretical foundations and evolution of this research, which is now known as the "interactionist" approach to SLA, is documented in a number of sources, particularly by Pica (Pica, 1994; Pica, Kanagy, & Falodun, 1993; Pica, Lincoln-Porter, Paninos, & Linnell, 1996). I will explain only briefly the research methods and the assumptions they rest on in terms of their significance for the study of CALL, but it is first necessary to justify the relevance of this line of research to the critical questions about CALL.

APPLYING RESEARCH ON INSTRUCTED SLA TO CALL

To consider research methods for evaluating CALL activities and informing their design, it is essential first to identify the relevant research questions. Many questions can be posed such as those focusing on evaluation of the interface, the quality of the program's language recognition procedures, the learners' apparent (dis)satisfaction, or their opportunities to engage in cross-cultural exchanges. Each of these factors may contribute to the degree of success of a CALL activity, but because the purpose of CALL activities is L2 learning, the most critical questions to be addressed about CALL are the following:

- o What kind of language does the learner engage in during a CALL activity?
- o How good is the language experience in CALL for L2 learning?

The first question requires description of the language that learners hear/read and produce during the CALL activity. It is critical because its answer provides the instructor a means of deciding the role that the CALL activity should play relative to other potential assignments. For example, to decide whether or not to assign a regular e-mail pal with whom students are to correspond during the course of a semester, the instructor needs to have an idea of the language that the learners are likely to engage in during the activity. Do learners tend to write a lot to each other, or just a few lines? Do they use the syntax,

vocabulary, and pragmatic functions that they need to practice to improve and expand their L2? Do they produce language showing evidence of the planning time they are allowed for composing and correcting, or does the language appear to be rapidly produced with little attention to its formal correctness? The answers to these and other questions about the language resulting from an assigned CALL activity are important for making decisions such as how much time should be spent on an activity.

The second question is evaluative. Evaluating the quality of learner language in an L2 task requires that some assumptions be held concerning the types of language use expected to be beneficial for L2 development. For hypotheses about what to look for in learners' language, CALL researchers can turn to the work of interactionist SLA researchers who operate under the assumption that the L2 is acquired through learners' interaction in the target language because it provides opportunities for learners to: (a) comprehend message meaning, which is believed to be necessary for learners to acquire the L2 forms that encode the message; (b) produce modified output, which requires their development of specifics of morphology and syntax; and (c) attend to L2 form, which helps to develop their linguistic systems (Krashen, 1982; Larsen-Freeman & Long, 1991; Nobuyoshi & Ellis, 1993; Pica, Holliday, Lewis, & Morgenthaler, 1989; Swain, 1985; Swain & Lapkin, 1995). Following from these assumptions about L2 acquisition, one can specify the observable features of learner language that should be ideal for acquisition. Features include signals which focus attention on language, and which may elicit a repetition or an expansion of previous language. These types of moves, which focus attention on language by repeating, recasting, and expanding on prior language, are believed to be beneficial for SLA and therefore identification of such sequences has been a means of investigating the quality of particular L2 tasks for acquisition. Example 1 illustrates these types of linguistic exchanges that have been identified in SLA research.

In short, the broad perspective of SLA classroom research holds the language of the classroom participants as central for evaluating the quality of learning. The results of such research in L2 classrooms and experimental settings have provided a clearer picture of the nature of language that occurs in classroom activities, in addition to hypotheses about the relative value for SLA of particular linguistic features. In the study of CALL, in contrast, only a few studies have attempted to document the nature of the linguistic exchanges that learners participate in (Abraham & Liou, 1991; Beauvois, 1992; Bland, Noblitt, Armington, & Gay, 1990; Chapelle, 1990; Chun, 1994; Goodfellow & Laurillard, 1994; Kelm, 1992; Kern, 1995; Mohan, 1992; Piper, 1986) and fewer have attempted systematic hypotheses about the value of the language of a CALL activity (Chapelle, 1994). In order to apply L2 classroom research to the study of CALL activities, it is useful to view CALL through the lense of the classroom researcher who studies the discourse constructed through the linguistic and non-linguistic moves of participants. To explain how CALL can be investigated from this perspective, I will describe three examples of CALL activities, and then outline descriptive and evaluative approaches for investigating them.

A Few Examples of CALL Activities

Generally speaking, the pedagogical goal of CALL activities is for learners to improve their ability in the target language by participating in linguistic interactions. It is useful to consider the types of interactions as belonging to two classes depending on who the participants are. When participants are learners working together through oral language or through written conversations taking place in computer-mediated communication, these conversations among the learners comprise the discourse intended for language learning. A different type of interaction takes place when the computer acts as a participant while one or more learners work interactively with a computer program. In other words, because of the different participants associated with each, the language of activities based on computer-mediated communication among learners would be expected to be different than the language of activities based on learner-computer interaction.

In addition to the participants, a second important dimension affecting the interaction is the type of goal that learners work toward during a task. If the learner accomplishes the goal through constructing and interpreting linguistic meanings, it is considered a "communicative" goal, whereas when the learner's sole focus is directed to linguistic form, the goal is considered to be non-communicative (e.g., Ellis, 1995). A communicative task may in fact interrupt the communication to focus on language en route to accomplishing a communicative goal, but the learners do not lose sight of what they are attempting to accomplish through the use of language. The participants and the goals would only be two of the activity characteristics expected to influence the language (see Chapelle, 1995, for an outline of a broader framework, and Chapelle, in press, for more detail). I have selected three examples of CALL activities all of which I would analyze as having communicative task goals. The first is conducted with learners as participants, while in the second and third, the computer and learner are the participants.

The first example is a CALL activity in a university-level, fourth-semester Brazilian Portuguese class held in the U.S. (Kelm, 1992). Students attended class three hours a week. For one hour each Friday, class was held in the microcomputer center of the university library. Before coming to the computer lab, students were assigned to read a particular Brazilian short story which was to serve as the topic for the computer-assisted classroom discussion. When the students arrived at the computer lab, they logged in and received a message from the instructor including three or four questions which the instructor had selected to probe their comprehension of the story or to open discussion of topics raised in the story. After receiving the instructor's message, students were able to enter the electronic discussion by typing their comments at their computers. When an individual student had completed a message and was satisfied with it, he or she would send it to the rest of the class. Others would be doing the same thing, each at his or her own pace. The result is a written conversation with contributions from all or many of the members of the class, as shown in Example 2. For more on the development of computer-mediated communication, see Bruce, Peyton, & Batson (1993), and for more on using this technology for L2 activities, see Warschauer (1995a, 1995b).

In the next example, learners work individually playing the role of an inspector, "Kommissar," who must interrogate suspects to discover which of them must have committed a crime (DeSmedt, 1995). Linguistic interaction is accomplished by the learner and the computer each taking turns in a written "dialogue." The learner, a student of German as a foreign language, composes and enters his or her questions in German at the keyboard. Questions, such as the ones shown in Example 3 are about the past actions and knowledge of the suspect. The computer program parses the learner's output and for each one returns a response representing the suspect's answer.

In the final example, the pedagogical goal is learning American idioms, but the learner also focuses on and works toward the communicative goal of story comprehension.

The story about an American executive who is transferred to South America has intentionally been constructed to contain a lot of American English idioms. The interaction is accomplished through learners non-linguistic moves (i.e., their mouse clicks for scrolling and for indicating requests for a definition). In this case, achieving the goal of comprehension should be interrupted each time the learner reaches an unfamiliar idiom and therefore clicks to get the definition. The exchange type would look as shown in Example 4.

I will refer to these three examples as "the Portuguese story," "the German interrogation," and "the ESL idioms," respectively, as I outline how each could be investigated through descriptive and evaluative research.

Descriptive Research on Instructed SLA Applied to CALL

Researchers' description of the language in L2 learning activities is centered around three aspects: the input provided to the learner, the learner's output, and the interaction that is constructed through the turns consisting of input and output. Each of these aspects can be described in five ways.

First, we can describe the pragmatic role of the target language in a given L2 learning task. Does the input, for example, function to provide new information, or as a display of a teaching point? Does the learner's output function as an expression of agreement or disagreement, for example, in order to meet the task goal? In the ESL idiom activity, the functions that the target language input performs are to transmit narrative information, make salient the linguistic items to be learned by the learner, and provide restatement for the idioms and the text containing idioms. The learners' output in the German interrogation is to request information, and in the Portuguese story it is to express opinions and ideas about the instructor's question and the other students' ideas. The interaction of the ESL idiom activity functions to provide meanings for the idioms; in the German interrogation, it constructs a dialog revealing the story of the suspects; and in the Portuguese story, it maintains collaborative discussion through nomination and development of a number of topics.

Second, the linguistic characteristics of the language can be described in terms of what aspects of the target language grammatical systems appear in the input to the learner, the output from the learner, and the interaction. The input of the German interrogation consists of short declarative sentences in past or present tense using the lexicogrammatical forms expressing location, reason, knowledge, and actions. The output from the learner in the German interrogation consists of short questions, primarily in the past tense. The output in the Portuguese story task is more varied. It is oriented around, but not completely constrained by, the language of the story in past tense. The orientation is not maintained as the learners move into a light-hearted discussion of the shoes in the story and then to grammatical correctness of the language they are working with. The linguistic characteristics of the CALL task interaction can be described in terms of its coherence, cohesion, and structure of text. One might describe the interaction of the Portuguese story task by tracing how the turns are structured to contribute to--or detract from--the quality of the learners' understanding of the story.

The third feature to describe is the character of the non-linguistic forms and moves. Unlike face-to-face activities, some CALL activities in which the computer acts as a participant are intended to rely on forms of communication other than the target language (e.g., icons and mouse clicks) to accomplish the task goal. CALL activities often include graphic input to the learner such as that found in the ESL idiom activity, in which input includes a picture of Daniel's dog "Bernie," which functions as a definition of both the dog that is the subject of the story and the term "Airedale." In the same activity, the form of the non-linguistic output is the mouse click used to request definitions and to move the story forward. These non-linguistic outputs work together with the linguistic input from the computer screen to accomplish the interaction. Other CALL activities which rely on the language to move the interaction forward have a less substantive use for non-linguistic characteristics. For example, in the German interrogation and Portuguese story activities, signals of end-of-turn are accomplished through mouse clicks or by pressing **return** to post or enter the learners' linguistic messages.

The fourth feature is the quantity of language. How much target language input does the learner receive? How much target language output does the learner produce? How much interaction does the learner engage in and how long are the learner's turns within the interaction? The German interrogation task is comprised of rather short turns by both the computer and the learner. This length is constrained because of the task goal of discovering whether or not the suspect is guilty in addition to the participants, one of which is the computer. The Portuguese story activity has neither of these constraints, but the turns in this

activity are also rather short. In the ESL idiom activity, a lot of input is provided to the learner, but the learner's output is minimal and all non-linguistic.

The fifth feature, the medium of language, refers to the manner in which the language is transmitted. In all of the examples, the target language is transmitted in written mode. In this sense, the three examples are not representative of the many types of CALL activities in which aural input is provided.

These five features help to identify what is relevant for describing the input, output, and interaction of CALL activities. Such descriptive work on the nature of the language entailed in various CALL tasks is an essential first step toward understanding the potential value of a CALL activity. As Loschky and Bley-Vroman (1993) point out with reference to grammar teaching, choice of an appropriate classroom task requires knowledge of the extent to which the language that learners need to practice is likely to occur, given the task goal, participants, and other task variables. The way of gaining this understanding is through description of observed language and non-language moves in CALL tasks. A second use of this descriptive work is to provide a means for assessing the degree of authenticity of CALL activities in relation to the activities learners will encounter outside class in the target language. Although there is a great need for this type of descriptive work by itself, description needs to be augmented by evaluative research.

Evaluative Research on Instructed SLA Applied to CALL

On the basis of the SLA theory and research I summarized above, suggestions have been made concerning the empirically observable criteria for evaluating the quality of the language that learners use while working on tasks. These suggestions provide a basis for identifying the ideal qualities of L2 input, output, and interaction.

The ideal qualities of input have been hypothesized in terms of their pragmatic role, linguistic characteristics, and quantity. With respect to quantity, more input is probably better than less, but not just any type of input is considered equally valuable. Good input, that is "comprehensible input" (Krashen, 1982), needs to play a role in helping the learner accomplish the task goal. The learner should comprehend its semantic and pragmatic function to meet a task goal and, at the same time, the input should provide new data for the learner's developing system. Examining the input alone, however, one cannot know whether or not it should be considered sufficient in linguistic level or amount for a given learner. Nevertheless, some input characteristics can be identified as potentially comprehension enhancing--and these may help to focus description of language in L2 tasks. The researcher might, for example, note whether or not the input has been modified through simplification, elaboration, added redundancy, or sequencing to make it "comprehensible" (Chaudron, 1988; Larsen-Freeman & Long, 1991). In the ESL idiom activity, for example, the idioms are modified upon the stu dent's request through definitional elaborations and restatements which simplify the input by increasing the lexical transparency. A second key question is whether or not the input is marked to help learners notice particular linguistic features (Schmidt & Frota, 1986; Doughty, 1991). Again, the ESL idiom activity provides an example, as the idioms are marked as hot spots.

Ideal output, sometimes referred to as "comprehensible output" (Swain 1985), is believed to be valuable when it plays a role in helping learners convey meaning while stretching their linguistic resources. Swain & Lapkin (1995) explained comprehensible output as follows:

In producing the L2, a learner will on occasion become aware of (i.e., notice) a linguistic problem (brought to his/her attention either by external feedback [e.g., clarification requests] or internal feedback). Noticing a problem 'pushes' the learner to modify his/her output. In doing so, the learner may sometimes be forced into a more syntactic processing mode than might occur in comprehension (p. 373).

The hypothesis is that the syntactic mode of processing helps learners to internalize new forms (Pica, Holliday, Lewis, & Morgenthaler, 1989) and to improve in the accuracy of their grammatical knowledge (Nobuyoshi & Ellis, 1993). Comprehensible output, which occurs in the language that learners produce to achieve communicative task goals, is observed in a sequence of linguistic interaction consisting of the learner's unsuccessful attempt at expression followed by his or her linguistic modification of the form perceived as problematic. The trigger that causes the learner to notice the problem in the original output may or may not appear in the text. If the learner's attention is drawn to the problematic form by another participant in the task, the text may reflect the interlocutor's clarification request, as the texts in Example 1 illustrate.

Of course, for a CALL activity to offer the opportunity for comprehensible output, it must require the learner to produce linguistic output. Activities such as ESL idioms in which all output from the learner consists of mouse clicks provide no opportunity for comprehensible output. In the Portuguese story activity, in contrast, learners do produce language to achieve a communicative task goal and therefore opportunities for correction are possible, but in order to conclude that the Portuguese story activity promoted such sequences, we would need to observe learners' output with corrections from their previous output. Corrections might be prompted by other students' requests for clarification or corrective feedback (Lightbown & Spada, 1990). Similarly, in the German interrogation activity, the potential exists for modified output, but research showing learners' corrections of their previous output would be needed before the activity could be recommended as a means for getting learners to produce comprehensible output.

The value of interaction for L2 development has been discussed in terms of the linguistic form and pragmatic role of the interactions. The linguistic form of a good interaction is hypothesized to occur when the normal interactional structure has been modified because the learner has requested, for example, a repetition, clarification, or restatement of the original input. The reason that the modified interaction is expected to be good is that it can function to negotiate the meaning of the input (Long, 1985). Larsen-Freeman and Long (1991) summarize this view of interactional modifications:

Modification of the interactional structure of conversation or of written discourse during reading ... is a [good] candidate for a necessary (not sufficient) condition for acquisition. The role it plays in negotiation for meaning helps to make input comprehensible while still containing unknown linguistic elements, and, hence, potential intake for acquisition (p. 144).

Ideally, then, we would want to observe interaction displaying learners' moves in which the normal structure of interaction was disrupted to request modifications of the input they had received. In the ESL idiom activity, mouse clicks on the idioms would constitute modification requests which interrupt the normal interactional structure of a written text. A second type of interactional modification believed to facilitate SLA is one that interrupts the normal interactional structure which is working toward a communicative goal to focus on linguistic form, that is, overt correction of linguistic errors learners produce while they are working toward communicative goals. Althought they are not illustrated in Example 3, such interruptions are intended as a part of the design of activities such as the German interrogation, in which the conversation is stopped to provide advice on grammatical errors while the learner is working toward the communicative goal.

Table 1 summarizes questions that may help researchers to focus investigations of the interactions from L2 tasks on the basis of hypotheses from SLA theory. These questions offer a starting point for addressing the relevant questions about CALL, but they have limitations. First, these hypotheses were made on the basis of research results from classroom tasks in which oral face-to-face language was the medium of communication. Second, the characteristics of observed interaction outlined above are those which are hypothesized to be positive; they do not constitute direct evidence of learning. The way of assessing the extent to which these processes impact eventual learning outcomes is to investigate task-based language in combination with learning outcomes. Nevertheless, it is useful to consider the implications of this perspective for CALL.

IMPROVING CALL ACTIVITIES THROUGH L2 CLASSROOM RESEARCH

If one accepts the tenets of interactionist SLA research, some ideal approaches to CALL design and evaluation are evident. Activities should be designed to create opportunities for comprehension of linguistic input through modification of the normal structure of interaction. We currently see some activities such as the ESL idiom example which require application of the principle of "interactional modification." This principle is also applied to activities with audio and video input in which modifications consist of simplified aural input (e.g., segmented input), textual transcription of the aural language, or elaboration on meaning and usage of the language of the input. These interactional modifications initiated by the learner on input from the computer should yield similar psycholinguistic effects as those in oral face-to-face linguistic exchanges in which they were first investigated. However, it is necessary to investigate the effectiveness of such interactions for acquisition of the specific linguistic items for which interactional modifications are observed, as Hsu (1994) has done.

Activities are also needed which provide opportunities for production of comprehensible linguistic output. Activities, such as the ESL idioms, in which learners' output consists solely of mouse clicks, contain no such opportunities. Comprehensible output can occur when learners communicate with each other or interact through language with a computer program. It is important to note, however, that not just any linguistic production is considered beneficial "comprehensible output" from the interactionist perspective. Work is needed to better understand the types of CALL activities that promote learners dual concern for communicating linguistic meaning while attending to and correcting their linguistic form. Based on SLA research investigating the effects of various task goals, one can predict that activities such as the Portuguese story activity are unlikely to result in learners' production of comprehensible output because the goal does not require the participants to converge intellectually or to produce a tangible outcome, and student participants may be unwilling or unable to correct each other. Activities such as the German interrogation, on the other hand, require production of language that is sufficiently meaningful and correct that the computer program can interpret it. Learners run into difficulty when the output is not comprehensible, and therefore they are prompted to attend to form and make corrections. Although the Portuguese story and the German interrogation appear to contrast in the likelihood for fostering comprehensible input on the basis of the activity participants, it is important to note that it is not the participants alone that make the difference; the task goal also plays a role in affecting learners' output.

Both of these suggestions rest on the premise that activities are needed for directing learners attention to form -- both the formal characteristics of the linguistic input and those of the output that the learners produce. It is important to distinguish these suggestions from those underlying CALL activities in which the focus is grammar alone. As Underwood (1984) pointed out many years ago, CALL in which the task goal is completion of formal grammar exercises would not be considered within the purview of communicative teaching practices. What was not very well understood years ago, however, is the importance of learners' attention to form periodically while they are working toward a communicative task goal. CALL activities can do this through, for example, displaying hot spots with links to supporting

materials, highlighting relevant forms (Doughty, 1991), and signaling learners when they have made errors (Chanier, Pengelly, Twidale, & Self, 1992). The effectiveness of these features needs to be investigated empirically.

STILL IN SEARCH OF RESEARCH PARADIGMS?

As we approach the year 2000, the technical realities for CALL have expanded far beyond prior expectations. To attempt the best pedagogical applications for this technology, research on CALL use is needed. The approaches outlined above are based on L2 classroom research in general and interactionist research in particular, which direct us to investigate two critical questions about CALL:

- o   What kind of language does the learner engage in during a CALL activity?
- o   How good is the language experience in CALL for L2 learning?

L2 classroom research suggests the need for descriptive research documenting the nature of the interaction that learners engage in within various CALL contexts. In other words, it is essential for CALL research to observe learners' linguistic and non-linguistic interactions in order to understand the nature of the task. Hypotheses made by interactionist researchers provide guidelines for focused description, looking for particular aspects of the interaction that we expect to be positive for SLA.

In my view, these questions and methods are fundamental for choosing classroom activities, but they are, of course, not the only questions that one might pose about CALL use nor the only informative approach to research. For example, one might also investigate the extent to which learners have mastered a specific linguistic point, the metacognitive strategies learners use while working on CALL, or the quality of the cross-cultural experience they gain through CALL. Accordingly, other research methods, such as experimental, correlational, introspective, or ethnographic methods, might also be used. However, if progress is to be made in CALL, it seems necessary to shift from general approaches such as those of psychology, computational linguistics, and educational technology to the specific questions and methods of researchers who investigate instructed SLA. With SLA research as a basis for investigation of CALL, the paradigm search of the next decade can be a quest for methods that complement our fundamental understanding of the language experience learners engage in through CALL activities.

ABOUT THE AUTHOR

Carol Chapelle is a professor in the Department of English and Program in Linguistics at Iowa State University where she teaches courses in second language acquisition, language testing, and computers in applied linguistics. She has published extensively in the areas of computer-assisted language learning and language assessment.

E-mail: carolc@iastate.edu

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Advancements in the design and use of computer-assisted language learning (CALL) activities require that key questions about CALL be identified and effective research methods be used to answer them. This article suggests looking to research on other types of second-language (L2) classroom activities for guidance in framing CALL research questions and in discovering relevant research methods. (Author/VWL). Citation. Chapelle, C. (1997). CALL in the Year 2000: Still in Search of Research Paradigms?. Language Learning & Technology, 1 (1), 19-43. Retrieved October 3, 2020 from https://www.lear Chapelle - CALL in the Year 2000-Still in Serach of Research Paradigms. Copyright. Â©

Despite these implications that informative research on CALL must wait for a completely articulated theory of language teaching or psycholinguistic processing model of a second language, it is clear that the need exists for perspectives and research methods that can guide in the development and evaluation of CALL activities today. The editorial comments in a recent issue of CALL Journal are among the places where one can find a statement of the urgent need for better research methods for CALL. Advancements in the design and use of computer-assisted language learning (CALL) activities require that key questions about CALL be identified and effective research methods be used to answer them. In this paper, I suggest looking to research on other types of second language (L2) classroom learning activities for guidance in framing CALL research questions and in discovering relevant research methods. I begin with examples from the CALL literature demonstrating the diverse perspectives (e.g., cognitive psychology, constructivism, psycholinguistics) which have been suggested as ways of approa Advancements in the design and use of computer-assisted language learning (CALL) activities require that key questions about CALL be identified and effective research methods be used to answer them. This article suggests looking to research on other types of second-language (L2) classroom activities for guidance in framing CALL research questions and in discovering relevant research methods. (Author/VWL). CALL in the year 2000: Still in search of research paradigms? Language Learning & Technology, 1(1), 19â€"43. Retrieved from http://llt.msu.edu/vol1num1/chapelle/.Â Pedagogy, process, and classroom context: Integrating teacher voice and experience into research on technology-enhanced language learning. The Modern Language Journal, 93, 754â€"768.CrossRefGoogle Scholar. Godwin-Jones, R. (2015).