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Student's Strategies with Learner-Controlled CALL

Carol Chapelle
Iowa State University, carolc@iastate.edu

Suesue Mizuno
Iowa State University

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Student's Strategies with Learner-Controlled CALL

Abstract
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Disciplines
Bilingual, Multilingual, and Multicultural Education | Curriculum and Instruction | Educational Methods

Comments
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ABSTRACT: A degree of learner-control is implicit in most current CALL activities; however, research to-date has not investigated students' performance in such environments. This paper reports a first step toward the necessary investigation by documenting students’ use of five strategies while they worked on learner-controlled CALL grammar lessons. The results indicated the need for teachers and researchers alike to observe students use of CALL.

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Introduction

Many current approaches to CALL, in keeping with computer-assisted instruction and second language acquisition theories, suggest that the computer should provide an environment to be explored and a resource to be exploited by the learner. Some degree of this learner-controlled approach is implicit in a variety of CALL activities in which the student is the initiator, directing the interaction, requesting and interpreting information from the computer, and deciding what to do and when to do it. By requiring students to make such decisions, learner-controlled software assumes that learners know how to direct their learning, request appropriate information, and interpret it accurately. Are these assumptions valid? In fact, few empirical data exist to document students' actions in learner-controlled CALL environments. Researchers have however studied the strategies of learners working on other language learning tasks.

One such researcher reported the insight gained from assessment of students’ strategies for completing some of their regular French assignments. Hosenfeld asked students to think aloud while they were working on their exercises in French; she concluded the following:

We as foreign language teachers have made many assumptions about what students are doing. We assume that in a reading-grammar drill students are attending to the meaning because if we ask for the meaning, they can tell us. But in all of these exercises [Hosenfeld investigated], this student was not attending to the meaning and could clearly tell us how she was
not and, moreover, that it was not really necessary for the task. The lesson for all of us as classroom teachers is that students are often doing something very different from what we assume they are doing.” [emphasis added] (Hosenfeld, 1976: 123).

This observation, supported repeatedly over the past 13 years of research on second language learning strategies, has underscored the necessity of establishing an empirical basis for assumptions about what students do while they work on the language tasks intended to help them with their second language.

CALL activities, like other exercises, require observation to verify that students actually work as software developers intend them to, particularly on activities which provide little guidance. This paper reports such observation which focused on strategies used by students as they worked on learner-controlled CALL grammar lessons. First, learner-controlled CALL in theory and practice is reviewed, and relevant research on learner-controlled software is noted. Because learner-controlled activities require students to use particular learner strategies, strategies are defined spotlighting the five necessary for students’ work on the learner-controlled lessons used in this research. The data indicated that although some of the desired strategies had been used by students, continued strategy research on CALL materials is needed.

Learner-Controlled CALL Activities

Although the principle of learner-controlled computer activities did not originate with Papert (1980), it is exemplified by his philosophy concerning the relationship between student and computer: "In many schools today, the phrase 'computer-aided instruction' means making the computer teach the child. One might say that the computer is being used to program the child... [emphasis added]" (Papert, 1980:5). Papert’s philosophy of learner-control reflects an aversion to behaviorist principles of the program “knowing” what the learner needs and how that material should be taught. This philosophy is consistent with Krashen’s (1982) popular input hypothesis which denounces the value of explicitly taught linguistic material (the kind of material that a program might teach) in favor of implicitly acquired language (language acquired through experience). Consequently, aspects of learner-control are an integral part of much of today’s CALL. For example, grammar checkers allow students to test the grammaticality of their own sentences and decide how to use the computer’s analysis (Reid, 1986; Loritz, 1987). Exploratory programs offer an environment for students to test their hypotheses about an aspect of the target language (Higgins and Johns, 1983). Adventure games (Culley, Mulford and Milbury-Steen, 1986) present a challenge that can be solved using the linguistic and strategic moves that the student
devises. Hypermedia programs (Underwood, 1989) entice educators with capabilities for providing students with more information, more to explore, and a wider array of decisions to make.

These CALL practices have been accompanied by theorizing on the value of learner-controlled CALL. Typifying CALL theory, the principle of *artificial unintelligence* (Higgins, 1987) emphasizes the superior intelligence of the student over the computer and consequently the advisability of putting the intelligent student in control of the machine. This principle supports what Higgins calls the *pedagogue* role of the computer—the computer as slave to the student, available to do as the student directs, supplying requested information, waiting for the student to decide what to do next. Underwood, too, in his premises for *communicative CALL* echoes the learner-controlled principle: "Communicative CALL will be flexible" and "will allow the student to explore the subject matter" (1984: 53). In other words, the student, not the program, should be in control. Theory supporting the use of computers to provide a learner-controlled linguistic environment is pervasive, but is empirical research justifying this theory as ubiquitous?

Research on CALL has not yet investigated the issue; research from other subject areas suggests that students' capacities for benefiting from learner-controlled programs may be related to student factors. Studies attempting to relate the degree of learner-control in instructional materials to performance on criterion measures report performance to be somewhat dependent on the subjects' ability levels (e.g., Ross and Rokow, 1981; Halloway, 1978). Steinberg summarizes several such studies: "...results showed that not all students were capable of making appropriate educational decisions. The poorest decision makers were the students who knew little about the subject or who were performing poorly in it" (1977: 88).

Aside from that noteworthy conclusion, research from other subject areas falls short of providing necessary insights for CALL. Second language acquisition, as a "subject" is different from other subjects; consequently, research objectives and methods for the study of language teaching are unique. One such research objective is represented by current focus on language learning strategies, which are seen as a key to understanding the process of second language acquisition. Past research, focusing on learning outcomes (products) has failed to illuminate the strategies students use while they are working. Therefore, when low-ability students perform poorly on a criterion measure, it remains unclear how their work with the courseware may have failed to facilitate their eventual achievement.

As a first step toward the necessary description of students' CALL strategies, this research identified five strategies which students were assumed to be using while working on learner-controlled CALL grammar lessons. Strategies that students are expected to use correspond to elements of learner control present in the lessons. In other words, instructional moves not structured by the
program (i.e., aspects of the program that are optional for the students to choose) assume particular actions on the student's part as listed in Table 1.

Table 1—Options offered and assumptions made by learner-controlled software

<table>
<thead>
<tr>
<th>Learner-controlled software offers as options...</th>
<th>We assume students will...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Helpful explanations</td>
<td>Ask for the ones needed</td>
</tr>
<tr>
<td>Timing of explanations</td>
<td>Ask when they are needed</td>
</tr>
<tr>
<td>Number of transactions</td>
<td>Do a sufficient number</td>
</tr>
<tr>
<td>When to modify responses</td>
<td>Modify as needed</td>
</tr>
<tr>
<td>Which transactions</td>
<td>Choose maximum variety</td>
</tr>
<tr>
<td>Action after computer message</td>
<td>Use message to decide</td>
</tr>
<tr>
<td>When to quit working</td>
<td>Use performance to decide</td>
</tr>
</tbody>
</table>

For example, a program that offers students a choice of several kinds of help assumes that they will ask for the relevant help at appropriate times. These anticipated student behaviors correspond to learning strategies that second language researchers have identified in other contexts.

Learner Strategies

Second language learner strategies have been defined and studied in a number of different ways over the past fifteen years. For the purpose of this study, strategies are defined as "the language learning behaviors that learners actually engage in to learn and regulate the learning of a second language" (Wenden, 1987: 6). These behaviors that students use have been identified inside and outside language classrooms by observing students' actions or asking them to report on what they are thinking as they work on an activity or just after they have completed a task. From the many strategies that have been identified, five are particularly important if students are to work successfully on the grammar lessons used in this research.

First, the computer provides help only upon request so students must ask for the help they need when they need it. Students' requests for help are evidence of their use of resourcing, use of target language reference materials. O'Malley,
Chamot, Stewner-Manzanares, Kupper, and Russo (1985) identified resourcing as a strategy used by some students who use dictionaries and grammar reference books to help them in ESL.

Second, the computer doesn’t define how long students must work or how many transactions’ students must complete in a lesson. Instead, students work until they think they have practiced enough. The success of this feature of lesson design relies on the students use of a practice strategy. More specifically, the practice students must engage in is distinguished as formal practice because they are practicing to improve formal language skills in a context devised specifically for second language practice. Bialystok (1981), who found that some students use formal practice, distinguished this strategy from functional practice: finding opportunities to use the language in communicative situations.

Third, part of the lesson’s task requires students to check part of a sentence for grammatical correctness and to edit it if it is not correct. In other words, this aspect of the task requires students to monitor linguistic output. Self-monitoring is a strategy defined as attending to and correcting the formal elements of the language produced by oneself. Krashen’s (1982) monitor model theorizes variation in learners’ use of monitoring. Evidence for students’ use of monitoring has been found in a number of empirical studies (e.g., Bialystok, 1981; Abraham, 1983; O’Malley, et al., 1985; Jamieson and Chapelle, 1987).

Fourth, the lessons also allow for students to select (from a pool of choices) the sentences that they work on. That is, the program doesn’t specify which sentences will be given to students; once a student tries a sentence, the program simply gives feedback messages on it. Students are free then to choose all of the same type of sentences, or they can choose a variety. They can use the computer’s feedback message they receive on one sentence in selecting subsequent sentences, or they can ignore it. Ideally, students will choose a variety of sentences and will work with the computer messages to optimize practice with the material in the lesson. However, doing so requires that the student use self-management while working on the task. Self-management—understanding and creating conditions for one’s own learning—has been identified as a strategy used by some ESL students (O’Malley, et al., 1985).

Fifth, because the lesson does not tell students when they should quit working, it is their responsibility to make that decision. In other words, the lesson assumes that students will self-evaluate their ability on the task to decide when they should end their session. Self-evaluation, defined as assessing one’s own learning and learning needs, has been found as a strategy used by some ESL students (O’Malley, et al., 1985) and the importance of this strategy has been hypothesized (Wenden, 1985).

These five strategies have been identified in other language learning.
contexts. However, most second language researchers are in the descriptive phase of strategy research, seeking to identify and measure strategies rather than making definite hypotheses about the value of particular strategies in various contexts (Skehan, 1989). In the CALL under investigation, in contrast, it is reasonable to assume that use of the five strategies is important for successful participation in the activity. If the lessons are to have a potential positive effect on students, these strategies must be used by all learners as the work.

Is the assumption that all students will use the necessary strategies a valid one? According to second language learning researchers, strategy use varies from one student to another. Consequently, it is essential that students’ strategies be observed to determine whether they use resourcing, practice, self-monitoring, self-management, and self-evaluation. Specifically, the questions under investigation are the following:

1. How much did students use resourcing while they were working on the lessons?
2. Did the high and low level students use the same amount of resourcing?
3. Did the high and low level students use resourcing appropriately?
4. How much did students practice on lessons which were assigned to them?
5. Did high and low level students engage in the same amount of practice?
6. In what percentage of the lessons done by students are self-monitoring, self-management, and self-evaluation evident?
7. Are these percentages similar for high and low level students?

Methods

Subjects
International students enrolled in five ESL grammar/composition classes at Iowa State University (ISU) during spring semester of 1988 were chosen as subjects. There were 105 students in those classes; however, included in the study were only data from the 34 students who worked on the CALL grammar lessons longer than a total of 30 minutes and who responded to a questionnaire. The subjects represented 12 different countries; there were 24 males and 10 females. From the 34 subjects, a group of high English proficiency students and a group of low proficiency students were selected, based on their scores on an English placement test they had taken when they entered the university. The high proficiency group (n=7) was defined as those with scores greater than one standard deviation above the mean, and the low proficiency group (n=6) was defined as those students whose placement test scores were one standard deviation below the mean.
Materials

The CALL grammar lessons are part of a series of grammar and paragraph development lessons (Chapelle and Boysen, 1987) for high-intermediate to advanced ESL students. These students have studied English for many years and yet for many of them use of grammatical forms is not yet sufficiently automatic (in MacLaughlin's [1987] sense) when students have to attend to both what they are writing and the language they are using. The lessons, therefore, allow students to review and practice the correct forms and appropriate use of academic English grammar in a context in which they have to attend to both form and meaning. The main "page" of one of the lessons, illustrated in Figure 1, consists of three groups of phrases: subjects, verbs, and complements.

---SUBJECTS---

Ford
General Motors
American auto workers
General Motors and Ford
The American automobile industry
An American automobile company with multinational interests

---VERBS---

be
have
face
use
manufacture

---COMPLEMENTS---

a multinational company.
automobiles outside the U.S.
automobiles in the U.S.
35% interest in Isuzu of Japan
competition from abroad.
auto parts from a Japanese company.
financial problems.
low cost foreign labor.

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

PF1 Words PF2 Facts PF3 Grammar PF4 Exit

Figure 1—Screen display from phrases page of Grammar Lesson 1: Subject-Verb Agreement
The grammar focus of this lesson is subject-verb agreement, although the verb recognition algorithm will respond to other verb errors as well. To do the exercise, the student chooses a phrase from each group, and the computer plots each phrase as it is chosen on the lower portion of the screen thus forming a sentence. Next, the student must edit the verb in each sentence to make it the correct form, i.e., to make it agree with the subject. As the student works, help is available (labeled as Facts). The facts page uses the table format illustrated in Figure 2 to display the subjects and actions which are true. Ideally, the student will consult the FACTS help to learn about the situation, and will then be able to choose phrases composing sentences that are true, and edit the verbs to make them grammatically correct and appropriate for the meaning of the sentence.

PROBLEMS AND SOLUTIONS IN THE AMERICAN AUTO INDUSTRY

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PROBLEMS

- competition from abroad.................................................everyone in the industry
- financial problems.............................................................everyone in the industry
- low-cost foreign labor........................................................American auto workers

SOLUTIONS

- becoming multinational..................................................General Motors and Ford
- using foreign labor.............................................................multinational companies
- continuing production of U.S. automobiles................everyone in industry
- producing automobiles outside the U.S.........................multinational companies
- attaining 35% interest in Isuzu of Japan.........................General Motors
- importing auto parts from a Japanese company..............Ford

Figure 2 -- Screen display from facts page of Grammar Lesson 1: Subject-Verb Agreement

While all students are expected to need help with the facts of the lesson's topic, the American automobile industry, some students will also require definitions of words in the phrases or a review of the verb forms and their uses. To receive help with words, the student press PFI (as indicated on the bottom of the screen); the computer asks "Which word?" The student types the word, and the program returns its definition. To receive help with the verbs, the student is
offered two types of grammar help: several pages summarizing the grammar rules and forms, or a step-by-step tutorial of how to form and edit the sentences in the exercise. All of the help—facts, dictionary, and grammar—is optional; if a student does not request to see these parts of the program, s/he never will. Instead, a student can work on the exercise simply by forming and editing sentences and reading the computer’s evaluation of the sentences.

The computer evaluates and returns feedback messages (as illustrated in Table 2) for every sentence that the student forms.

Table 2—Example sentences and computer's judging messages

<table>
<thead>
<tr>
<th>Student's Sentence</th>
<th>Computer's Message</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MEANING ERRORS</strong></td>
<td></td>
</tr>
<tr>
<td>American auto workers are a multinational company</td>
<td>The meaning doesn't make sense because American auto workers can't be a multinational company</td>
</tr>
<tr>
<td>Ford has 35% interest in Isuzu of Japan.</td>
<td>That sentence is not true because of the subject, Ford.</td>
</tr>
<tr>
<td><strong>VERB ERRORS</strong></td>
<td></td>
</tr>
<tr>
<td>General Motors is having 35% interest in Isuzu of Japan</td>
<td>You cannot use the progressive form (-ing) with have in this sentence.</td>
</tr>
<tr>
<td>General Motors manufacture automobiles outside the U.S.</td>
<td>You need the singular form of the verb (manufactures) to agree with the singular subject, General Motors.</td>
</tr>
<tr>
<td>The American automobile industry facing competition from abroad.</td>
<td>You can’t use the (-ing) form for the first auxiliary.</td>
</tr>
</tbody>
</table>

When a sentence is incorrect, there are two possible problems: its meaning or its verb form. 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: those which have the wrong tense, aspect, or number given the subject and meaning of the sentence,
and those in which the verb is incorrectly formed according to the rules of English.

Procedures

The ESL grammar lessons were made available to three instructors to complement classroom instruction of their ESL grammar/composition classes during the spring semester of 1988. To introduce the students to the computer and its software, an orientation was provided during two consecutive class hours early in the semester. Each instructor then decided how best to integrate the software into her course(s). One instructor left it up to her two classes to decide if and how they would use the lessons. Another instructor assigned as homework three of the grammar lessons; the other assigned four.

As each student interacted with the computer, every move was recorded and stored in a separate file for each student. The resulting data document choices of phrases, edited forms of words or phrases, messages returned by the computer, choices of help options, and the time of the key presses. Based on these data, the following information was obtained: the total amount of time each student spent on the grammar lessons, the number of sentences each student constructed in each lesson, the total number of times s/he used each help option in each lesson, how each student edited responses, which phrases students chose, and feedback messages given by the computer. These data were used as evidence for students’ use of the five strategies under investigation.

Measures of resourcing and practice were derived algorithmically from the data. These two can be termed low-inference (see Chaudron, 1988) strategies because the behavior exhibited for each provides unequivocal evidence for students’ use of these strategies; in a sense, the behavior is the strategy. The other three strategies, on the other hand, can not be so algorithmically interpreted. What specific behaviors indicate that a student has self-evaluated, for example? For strategies such as self-evaluation, the researcher must make a judgement as to whether the observable data (e.g., the correctness of the sentences the student does, the number of sentences done) indicates that the student self-evaluated. These high-inference strategies were measured with much less precision in this study, where the objective was to determine whether students used these strategies at all rather than to quantify the amount of strategy use. The specific procedures used to measure each strategy are as follows:

Resourcing. When students chose the grammar, facts, or dictionary help they were using resourcing. Their use of resourcing was examined from two perspectives: amount and appropriateness. Amount of resourcing refers to how frequently students requested the help options, and therefore was measured by frequency of each student’s request of the help options standardized in two ways: the frequency of help requests was divided by the amount of time each
student spent on the lessons, and the number of help requests was divided by
the number of sentences that the student constructed. Appropriateness of
resourcing was determined on the basis of whether the student’s choice of help
corresponded to the kind of error made. For example, the choice was considered
appropriate when the student received a grammar error message and then asked
for grammar help. If the student requested the facts help instead, the choice
would be counted inappropriate (for detail see Mizuno, 1989).

Formal Practice. When students used the lessons, they were considered to be
practicing. Practice was quantified in two ways: the amount of time students
spent on the lessons, and the number of sentences they created. The amount of
time included the time they spent selecting phrases, editing phrases, and using
the help options. Each sentence was counted as one regardless of how many
times it was edited.

Self-monitoring. Self-monitoring is apparent when students edit their sentences
to make them grammatically correct. Appendix A illustrates a protocol of a
student who did not self-monitor; he selected phrases to form a sentence, but
then, despite the error messages received from the computer, did not edit that
verb. Appendix A also illustrates a protocol of a student who did self-monitor as
evidenced by his editing the verb, not necessarily correctly. If, within a lesson, a
student monitored at all, the lesson was assigned a "1," but if there was no
evidence of monitoring (as in the first example in Appendix A), the lesson
received a "0." The lessons receiving a "1" were added together and that total was
divided by the total number of lessons evaluated to obtain a percentage of
lessons in which the strategy was apparent. This scoring procedure was used for
self-monitoring, self-management and self-evaluation. To make a valid
judgement concerning these strategies it was necessary to have an extended
segment of interaction between the student and the computer; therefore, only
lessons in which students did at least seven sentences were considered.

Self-management. Self-management is apparent when students construct
sentences to allow themselves sufficient practice with all aspects of the lesson's
point and they appear to use a feedback message on one sentence to choose
subsequent phrases. Appendix B illustrates data in which this strategy was
evident by the student's apparent use of feedback messages to pursue plans.
When the student is at last successful with one sentence, he then moves to
another. Presence or absence of self-management in each lesson was scored as
described above; a percentage of lessons with self-management was calculated.

Self-evaluation. Self-evaluation is apparent when students assess their readiness
to terminate their work on the lesson. Students’ failure to self-evaluate appeared in cases in which they quit before they were successful at the task (i.e., they got the majority of their sentences incorrect, and then exited). A typical pattern that was evaluated as not using self-evaluation was a series of incorrect sentences followed by only one correct sentence, followed by termination. In contrast, if students tried a number of different sentences, and got the majority of them right before ending the lesson, they were judged as having self-evaluated.

These data (obtained by analyzing each subject’s file) along with the students’ English placement test scores were entered into a computer file to be analyzed using a statistics program, SPSSX (Norius, 1983). Descriptive statistics and t-tests comparing the performance of the high and low groups were computed. Discussion of the results addresses seven questions concerning students’ strategy use.

RESULTS

1. How much did students use resourcing while they were working on the lessons?

Table 3 summarizes the number of help requests standardized by minutes spent working and by the number of sentences attempted. Both sets of numbers show that the help options were not used very often. For example, on average, some kind of help was requested about once every 8.6 minutes (\(0.16 \times 8.6 = 1\)) or once every 4.35 sentences (\(0.23 \times 4.35 = 1\)). Of the three help options, both methods of measurement indicate that the facts help was most frequently used, although just slightly more than the grammar help. These data verify that students did use a resourcing strategy as they were working on the lessons. It seems that these students did not use resourcing often; these data do not, however, address the question of whether resourcing was used by the right students at appropriate times.

Table 3—Mean frequencies of help requests for the whole subject group (n=34)

<table>
<thead>
<tr>
<th>TYPE OF HELP</th>
<th>Help requests per minute</th>
<th>Help requests per sentence</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(\bar{x})</td>
<td>s.d.</td>
</tr>
<tr>
<td>Grammar</td>
<td>.044</td>
<td>.053</td>
</tr>
<tr>
<td>Dictionary</td>
<td>.025</td>
<td>.042</td>
</tr>
<tr>
<td>Facts</td>
<td>.047</td>
<td>.046</td>
</tr>
<tr>
<td>All Help</td>
<td>.116</td>
<td>.108</td>
</tr>
</tbody>
</table>
Table 4—Comparison of help use (divided by minutes spent working) between high-level (n=7) and low-level (n=6) students

<table>
<thead>
<tr>
<th>HELP GROUP</th>
<th>HELP REQUESTS PER MINUTE</th>
<th>S.D.</th>
<th>T-VALUE</th>
<th>DF</th>
<th>SIG.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grammar</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>.0364</td>
<td>.0284</td>
<td>.1914</td>
<td>11</td>
<td>ns</td>
</tr>
<tr>
<td>Low</td>
<td>.0268</td>
<td>.0286</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>.0236</td>
<td>.0337</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dictionary</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>.0346</td>
<td>.0228</td>
<td>-.6974</td>
<td>11</td>
<td>ns</td>
</tr>
<tr>
<td>High</td>
<td>.0267</td>
<td>.0333</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Facts</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>.0763</td>
<td>.0515</td>
<td>-2.0242</td>
<td>11</td>
<td>ns</td>
</tr>
<tr>
<td>High</td>
<td>.0867</td>
<td>.0587</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All Help</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>.1377</td>
<td>.0762</td>
<td>-1.3347</td>
<td>11</td>
<td>ns</td>
</tr>
</tbody>
</table>

Table 5—Comparison of help use (divided by number of sentences) between high-level (n=7) and low level (n=6) students

<table>
<thead>
<tr>
<th>HELP GROUP</th>
<th>HELP REQUESTS PER SENTENCE</th>
<th>S.D.</th>
<th>T-VALUE</th>
<th>DF</th>
<th>SIG.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grammar</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>.066</td>
<td>.063</td>
<td>.49</td>
<td>11</td>
<td>ns</td>
</tr>
<tr>
<td>Low</td>
<td>.051</td>
<td>.047</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>.027</td>
<td>.037</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dictionary</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Low</td>
<td>.075</td>
<td>.061</td>
<td>-1.68</td>
<td>11</td>
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<tr>
<td>High</td>
<td>.038</td>
<td>.042</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Facts</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>.152</td>
<td>.099</td>
<td>-2.63</td>
<td>11</td>
<td>p&lt;.05</td>
</tr>
<tr>
<td>High</td>
<td>.130</td>
<td>.086</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All Three</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>.279</td>
<td>.140</td>
<td>-2.27</td>
<td>11</td>
<td>p&lt;.05</td>
</tr>
</tbody>
</table>
2. Did the high and low level students use the same amount of resourcing?

Both measures of resourcing were used to compare the behavior of the high and low proficiency students. The differences in help use by high and low proficiency groups were small, and except for two cases not statistically significant (see Tables 4 and 5). When help was measured as requests per sentence, the low-level students were found to request more facts help than the high-level students. It is the difference in use of facts help that accounts for the significant difference in the use of help in general. It is somewhat surprising that it was the facts help which low level students used more than high level students. One would expect the low level students to need more help with the grammar and vocabulary, but that the need for help with the facts of the automobile industry would be similar for the two groups.

3. Did the high and low level students use resourcing appropriately?

 Appropriateness of resourcing usage was figured by studying contexts where help requests took place following computer error messages; these were termed help use for on-going problems-solving (see Table 6). For high-level students, 71% of these requests appeared to be appropriate for problem solving. Similarly, the low-level students selected appropriate help 67% of the time. There were also instances when a help request was not clearly linked to error messages. Those cases can be categorized in three groups. One occurred when students asked for help at the beginning of sessions, before starting sentence constructions, perhaps for advanced organization. Another type was observed when they requested help when no error messages had been so far received, as reconfirmation of what they had done. The other type was found when students solely looked up help contents without doing any exercises and exited the lesson, so the help request was extra information. The results indicated that, contrary to expectations, the two groups used help with approximately equivalent appropriateness, but that the low proficiency group tended to use resourcing for a greater variety of purposes than the high proficiency group.

4. How much did students practice on lessons which were assigned to them?

The mean number of minutes spent by students on assigned lessons was 17.8; the mean number of sentences was 7.7. However, to describe the amount of
Table 6—Comparison in resourcing performance between high-level (n=7) and low-level (n=6) students

<table>
<thead>
<tr>
<th>RESOURCING PURPOSES</th>
<th>GROUP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HIGH</td>
</tr>
<tr>
<td>On-going problem solving</td>
<td>78%</td>
</tr>
<tr>
<td>Advanced organization</td>
<td>7%</td>
</tr>
<tr>
<td>Reconfirmation</td>
<td>11%</td>
</tr>
<tr>
<td>Extra information</td>
<td>0%</td>
</tr>
<tr>
<td>Others (unknown)</td>
<td>4%</td>
</tr>
</tbody>
</table>

The practice strategy used, the mean scores alone do not tell the whole story. It is important to look also at the variation (illustrated in Figures 3 and 4) in the amount of practice students engaged in when they were not told how long to work or how many sentences to do. These results confirm the findings of other second language researchers who report variation in the strategies that students use.

Figure 3—Histogram indicating the mean numbers of sentences constructed by students on assigned lessons.
5. Did high level and low level students engage in the same amount of practice?

The amount of practice for high and low level students was compared by examining the mean number of minutes and mean number of sentences on assigned lessons for the two groups of students (Table 7). The low level students spent slightly more time on the lessons than the high level students, but they did
fewer sentences. In other words, as one would expect, the lower proficiency students tend to spend more time doing less. Despite these apparent differences, t-tests found them not statistically significant, so, statistically speaking, the high and low level students engaged in the same amount of practice.

6. In what percentage of the lessons done by students are self-monitoring, self-management, and self-evaluation evident?

   The percentages of lessons in which these three strategies appeared are listed in Table 8. There was evidence for self-monitoring and self-management in a large proportion of the lessons, whereas, self-evaluation was evident in fewer lessons. Despite the evidence for these strategies, it is important to restate that all lessons in which students did fewer than seven sentences were omitted from the sample of lessons because it was impossible to judge use of these strategies in protocols with such little information. A viable interpretation of those very short protocols, however, would be that they show no evidence of these strategies. Therefore, these results should be interpreted that there was some, but not a lot of, strategy use.

   Table 8—Percentage of lessons in which self-monitoring, self-management, and self-evaluation were evident

<table>
<thead>
<tr>
<th>STRATEGIES</th>
<th>% OF LESSONS</th>
<th># OF LESSONS*</th>
</tr>
</thead>
<tbody>
<tr>
<td>self-monitoring</td>
<td>82%</td>
<td>44</td>
</tr>
<tr>
<td>self-management</td>
<td>81%</td>
<td>52</td>
</tr>
<tr>
<td>self-evaluation</td>
<td>46%</td>
<td>52</td>
</tr>
</tbody>
</table>

   *Use of these strategies was assessed for lessons in which students did more than 7 sentences.

7. Are these percentages similar for high and low level students?

   Table 9 divides the percentages of lessons in which the three strategies are evident into those done by high-level and those done by low-level students. The small differences between the two groups should not be considered noteworthy given the small numbers of sample lessons for each.
Table 9—Percentage of lessons in which self-monitoring, self-management, and self-evaluation were evident divided by level

<table>
<thead>
<tr>
<th>STRATEGIES</th>
<th>HIGH LEVEL</th>
<th></th>
<th>LOW LEVEL</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>#</td>
<td>%</td>
<td>#</td>
</tr>
<tr>
<td>self-monitoring</td>
<td>63%</td>
<td>8</td>
<td>70%</td>
<td>10</td>
</tr>
<tr>
<td>self-management</td>
<td>100%</td>
<td>11</td>
<td>70%</td>
<td>10</td>
</tr>
<tr>
<td>self-evaluation</td>
<td>36%</td>
<td>11</td>
<td>50%</td>
<td>10</td>
</tr>
</tbody>
</table>

CONCLUSION

This research assessed the accuracy of the assumption that students would use five essential strategies while they worked on learner-controlled CALL materials. Results indicated that some students did indeed use some of the strategies some of the time, thereby partially justifying the hypothesized strategy use. However, the results also confirmed Hosenfeld’s (1976) observation that students are often doing something different from what instructors believe they are doing; they do not always use the optimal strategies. What do these findings imply for current use and future research and development of learner-controlled CALL?

When learner-controlled CALL activities are assigned, some students may use desirable strategies while they work; others may not. It is necessary then to observe students’ use of CALL. This point was particularly crucial with respect to the practice and self-evaluation strategies in this research. Of the 105 students who were initially introduced to the lessons, only 34 practiced with the lessons for 30 minutes or more. Of those 34 students, there was variance in the amount each student chose to practice—variance that would be appropriate if students were able to self-evaluate accurately enabling each to make well-founded decisions about readiness to quit working. However, the data on self-evaluation indicated this strategy was apparent in only some of the students’ work. In other words, these data indicate that instructors should not have expected all their students to assess their own needs for practice or to determine whether or not they had achieved their instructional objective.9

Note, however, that it would be inaccurate to suggest that all students everywhere are likely to perform as the subjects in this study did on all learner-controlled CALL. The students in this research were mature, university-level adults from a variety of countries and academic fields. Their problems with English, and undoubtedly, their motivations for studying English were varied as
well. Other kinds of students may have behaved differently. Moreover, the term learner-controlled used to describe this CALL activity, can have many different meanings. Therefore, it is not possible to generalize directly the strategies used with this software to those that may be used with other learner-controlled activities. Finally, the context in which the activities are done undoubtedly influences the strategies that students employ. If different instructors had introduced, assigned, and discussed the CALL materials, results may have been different. Moreover, if students had used the materials during class time or had had access to terminals in their apartments and dorm rooms, they may have worked differently.

The large number of relevant variables necessitates a research agenda for understanding how students use CALL. What strategies does an activity require a student to use? What kinds of students tend to work most successfully in a given CALL environment? What kinds of students consistently fail to use particular types of strategies? These challenges must be met to reach the eventual development of more intelligent courseware—courseware which is sensitive to students’ needs. Only through examination of empirical data of students’ CALL use will instructors become knowledgeable about assigning CALL activities and will developers ultimately be in the position to write courseware guiding students toward appropriate strategy use.

Notes

1 Krashen’s theory is popular because it is so simple and easy to understand while it appears to explain a lot. However, it has received numerous well-founded criticisms summarized in McLaughlin (1987).
2 An up-to-date collection of second language strategy research can be found in Wenden and Rubin (1987).
3 Transaction, in the sense used by Sinclair and Coulthard (1975), refers to a completed interaction which may consist of numerous exchanges (in this case, between student and computer). In these lessons, a transaction is referred to as completion of one sentence, regardless of the number of times the student edits that sentence.
4 In these lessons, the language corrected by the student is not, strictly speaking, produced by the student; it is selected from choices on the screen.
5 Although use of these strategies is necessary for potential benefits, their use does not assure that the lessons will be effective.
6 Results from the questionnaire, not reported here, can be found in Mizuno (1989)
7 The grammar lessons were only one part of the software package that the students used.
8 Ultimately, algorithms will be developed for identifying these strategies, but the first step was to see whether students used them at all, and whether the researchers could identify them in the data.
Based on this finding, the software has been modified to allow students to print out their sentences. This feature enables instructors to set objectives (i.e., do a certain number of sentences) for their students.

References


Appendix A

Example protocols illustrating students’ lack of use and use of self-monitoring

**NO SELF-MONITORING...**

<table>
<thead>
<tr>
<th>ACTION</th>
<th>RESULT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student chooses phrases</td>
<td>Ford be a multinational company</td>
</tr>
<tr>
<td>Student doesn’t edit</td>
<td>Ford be a multinational company</td>
</tr>
<tr>
<td>Computer judges</td>
<td>You need the singular form of the verb <em>(is)</em> to agree with the singular subject, <em>Ford.</em></td>
</tr>
<tr>
<td>Student doesn’t edit</td>
<td>Ford be a multinational company</td>
</tr>
<tr>
<td>Computer judges</td>
<td>You need the singular form of the verb <em>(is)</em> to agree with the singular subject, <em>Ford.</em></td>
</tr>
<tr>
<td>Student doesn’t edit</td>
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</tr>
<tr>
<td>Computer judges</td>
<td>You need the singular form of the verb <em>(is)</em> to agree with the singular subject, <em>Ford.</em></td>
</tr>
<tr>
<td>Student doesn’t edit</td>
<td>Ford be a multinational company</td>
</tr>
<tr>
<td>Computer judges</td>
<td>You need the singular form of the verb <em>(is)</em> to agree with the singular subject, <em>Ford.</em></td>
</tr>
</tbody>
</table>

*(student ends lesson)*

**SELF-MONITORING...**
ACTION
Student chooses phrases
Since the 1970s, car buyers begin to want small cars.
Student edits
Since the 1970s, car buyers began to want small cars.
Computer judges
You need the present perfect *(with have)* for this event because it happened in the past and continues now.
Student edits
Since the 1970s, car buyers have began to want small cars.
Computer judges
Use the *begun* form after *have*.
Student edits
Since the 1970s, car buyers have begun to want small cars.
Computer judges
The verb is correct in that sentence.

(Student chooses different phrases)

Appendix B

Example protocols illustrating a student's use of self-management

ACTION
Student chooses phrases
Until fuel prices rose, American companies began to produce small cars.
Computer judges
No. According to the facts, FIRST *fuel prices rose* and SECOND *American companies began to produce small cars*.
Student chooses phrases
Until automobile companies lost money, American companies began to produce small cars.
Computer judges
No. According to the facts, FIRST *automobile companies lost money* and SECOND *American companies began to produce small cars*.
Student chooses phrases
Until the events of the early 1970s, Americans drove very large cars.
Computer judges
That's a good sentence.

Student chooses phrases
As a result of fuel prices rose, American companies began to produce small cars.

Computer judges
You cannot use a clause with as a result of. Fuel prices rose is a clause because it has a subject and a verb.

Student chooses phrases
As a result of expensive domestic labor, American began to buy foreign cars.

Computer judges
No. According to the facts, FIRST American began to buy foreign cars and SECOND came expensive domestic labor.

Student chooses phrases
As a result of expensive domestic labor, American companies began to lose money.

Computer judges
That's a good sentence.

(Student chooses different phrases)

Authors' Biodata

Carol Chapelle is an Assistant Professor of English as a Second Language at Iowa State University, where she teaches courses in applied linguistics and ESL and conducts research on computer-assisted language learning.

Suesue Mizuno received her M.A. in TESL at Iowa State University. Her thesis topic was descriptive research on computer-assisted language learning for ESL students.

Authors' Address

Carol Chapelle and Suesue Mizuno
203 Ross Hall
Iowa State University
Ames, IA 50011