# Human-computer interaction and the effect of CALL : A case study*

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## Abstract

Taking the form of case study, this empirical research describes how the effects of computer-assisted language learning (CALL) differ, depending on types of learners in terms of affective variables and learning strategies toward CALL. A group of Japanese university students used original multimedia CALL material which was experimentally developed. The material was designed to help the students attain precise understanding of the text and familiarize them with authentic spoken English, in order to facilitate their oral activities based on it. The analyses of learning strategies were made with data from their learning logs recorded by the program while pre- and post-questionnaires were given to the students to assess their attitude toward CALL. Also, listening and speaking tests were administered before and after the individual CALL study. Comparisons of the results from these analyses showed enormous individual differences in the effect of CALL. Two pairs of contrastive cases are discussed in depth from the viewpoints of the listening and speaking test results, the attitude toward CALL and the actual use of CALL.

## 1. Introduction

As student-centered approaches become the norm of language

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teaching, more and more attention has been given to individual difference of learners. In the area of CALL, researchers have begun to explore the relationship between computer-assisted learning and learner variables such as age, gender, computer experience, learning strategies, cognitive styles, attitude and motivation. (Baily, 1996 ; Beauvois and Eledge, 1996 ; Chapelle and Jamieson, 1991 ; Chapelle and Mizuno, 1989 ; Dhaif, 1990 ; Hulstijn, 1993 ; Jamieson and Chapelle, 1987 ; Khine, 1996 ; Matsuura and Fujieda, 1997 ; Meunier, 1996 ; Stevens, 1991 ; Teh and Frasser, 1995). Methodologically, some recent strategy research has utilized computer programs which track learners' behavior on computer and compose a log file. With this technique researchers can observe learners' interaction with the computer unobtrusively. Hulstijn (1993) particularly looked at the "dictionary look-up" behavior of unfamiliar words in reading tasks. He claimed that this technique "constitutes a possibly valid means of investigating one aspect of the reading process" (p. 140). Jamieson and Chapelle (1987) collected the student-computer interaction data in spelling and dictation lessons for 13 weeks to see the general tendency of the learner's working style. Chapelle and Mizuno (1989) investigated 5 strategies --resourcing, practice, self-monitoring, self-management, and self-evaluation-- in a CALL grammar lesson and emphasized the necessity to observe students' use of CALL because "students are often doing something different from what instructors believe they are doing, they do not always use the optimal strategies" (p. 42). Baily (1996) employed this computerized observation technique to see the students' compensation strategies for writing, and to see the effectiveness of her strategy instruction.

While computer logs can give objective data, Jamieson and Chapelle (1987) recommended to "analyze computer-collected data along with data collected by ther methods" because "the use of several methods, each with unique strength and weaknesses, will allow for cross-validation that will result in more accurate assess-

ment of students' learning processes" (p. 543). The present study collects data from multiple sources and takes the form of a case study in an attempt to project an overall picture of the learner.

## 2.   Background of present study

As an English class normally meets only once a week for 90 minutes in Japanese universities, CALL material was created to compensate for students' lack of exposure to authentic spoken English and to facilitate their listening ability. This material is designed for out-of-class individual study, and is an integral part of the overall lesson. In an integrated language learning system, students are introduced to new material based on a video story in the first class meeting. After the first class, students study the CALL material individually preparing for the next class meeting. In the second class meeting, they have a chance to speak and interact with others using the words and phrases they've learned with the CALL material. Also, they have an opportunity to discuss culture and other related topics of the video story. This way, during the individual study, students can work on the material at their own pace, and limited class time can be devoted to improving their productive skills with a lot of human interactions and discussions.

The CALL material consists of five sections. Among them, four sections are designed to improve learners' linguistic knowledge and one section contains some cultural information as background knowledge to better understand the story. The four sections for improving liguistic knowledge include : 1) a section called "Script" which has the whole text, grammatical information, sound and a picture ; 2) a section called "Vocabulary", which is a multiple-choice exercise to check the meaning of the words and phrases ; 3) an exercise called "Linguistic Comprehension", which tests the learner's understanding of the plot by ture-or-false questions ; and 4) an exercise called "Partial Dictation", which asks the learner to arrange the words in

the right order. These sections prepare students for the oral production in the next class meeting. In the section called "Culture", extra information is presented in a game-like format for deeper understanding of the story. For the purpose of the experiment, three lessons were created using an authentic video story. Learners can start with any section they like, come back to the main menu and go to a different section as they wish. The program runs on a Macintosh platform and only requires clicking and dragging operations on the part of users.

## 3. Experiment

### 3.1 Objective

Using the CALL material, an experiment was conducted. The objective of the experiment was to investigate the individual differences in the effect of CALL focusing on the following three points: learners' attitude toward CALL, their actual use of CALL, and their degree of comprehension of the given material. A learner's attitude was assessed through pre and post questionnaires, and their comprehension was tested by pre and post listening tests and speaking tests.

### 3.2 Method

**Subjects.** A total of fifteen Japanese university students took part in this experiment (male=6, female=9) on a voluntary basis. They were all English majors aged from 20 to 22, and their TOEIC scores varied from 240 to 830. Eleven of them had taken a 1-year "Information Processing" class and were familiar with basic computer operations. To those who were not familiar with mouse operations, the researchers gave individual instructions prior to the experiment. On the first day, the experimental procedures were detailed to the subjects and the contents and structure of each section in the CALL program was explained. After data collection, four exemplary subjects were selected by the researchers for further analysis.

**Materials.** In addition to the above-mentioned CALL program, the following materials were prepared for data collection.

1. *"Today's Scene" video* : A part of the video story named "Today's Scene" was used in each experimental session. The content of "Today's Scene" video corresponded with the CALL program content, and each video lasted 5 to 10 minutes.

2. *Attitude questionnaires* : Two types of questionnaires were developed based on Matsuura and Fujieda (1997). The pre-session questionnaire asked the subjects to state their computer experiences and general interest in CALL as well as other demographic information.

The post-hoc questionnaire was given to the subjects immediately after each experimental session. Subjects were asked to respond to 13 statements regarding their attitude toward CALL by indicating either "agree" or "disagree". The 13 statements were categorized into four groups : positive statements regarding computer operations and computer programs (e.g., "CALL was fun because it was just like playing games."), negative statements regarding computer operations and computer programs (e.g., "I was sometimes afraid that I was doing something wrong with the computer."), positive statements regarding studying English with a computer (e.g., "I felt I would get to like English better by using CALL."), and negative statements regarding studying English with a computer (e.g., "No amount of CALL study can improve our English."). The same questionnaire was given to the subjects after each experimental session to see if their attitude changed over the three sessions. (See Appendix A.)

3. *Learning log* : The CALL material had a built-in function to keep the record of the subject's actual use of the program as a learning log. This learning log provided the researchers with the information about which buttons and frames the subjects chose while they were working on the program. The program also recorded the time when the subject clicked each button and frame. The log had

hierarchical structure with the far left column being the most superficial level of the program. The far right column showed the time elapsed. In other words, it tracked the learner's interaction with the computer : The more the right hand side column was marked, the deeper the learner went in the program by choosing the the options available. The data were collected after each CALL lesson and analyzed on both macro and micro levels. On a macro level, this learning log was utilized to see 1) which sections of the program the subjects chose to do, 2) in what order the sections were chosen, and 3) how long the subjects stayed in each section. On a micro level, the log showed such information as which questions the subjects answered correctly, and which functions/buttons the subjects used. Such data contributed to the analyses of subjects' strategy use.

4. *Listening tests* : The subjects' listening comprehension level of the video story was tested before and after their CALL study. A set of an edited video and an answer sheet was prepared for pre and post tests respectively. The video contained several scenes from the video story and each scene was played three times. The listening tests had three types of questions. The first one was to write a missing word in the blank. The second type was to write Japanese translation of the phrase, and the third one was to write a missing English phrase which consisted of 7 to 12 words. (See Appendix B.) The pre-test and the post-test had the same types of questions with different scenes. The percentage of right answers in each type of questions was calculated for the later analysis.

5. *Speaking tests* : The subjects were asked to speak about "Today's Scene" as much as they could. After viewing the "Today's Scene", the subjects recorded their speech onto an audio tape. Their speech was then transcribed and analyzed in terms of word total (the total number of words in the speech), vocabulary size (how many different words were used in the speech), number of sentences, words per sentence (the average sentence length), key words used (the

number of highlighted words in the "Script" used in the speech), and idea unit (the number of propositions in the story). The subjects' protocols were also analyzed qualitatively by comparing the pre and post results.

**Procedure.** Figure 1 shows the procedure of the experiment. Before and after an individual CALL lesson with the CD-ROM, subjects were given listening tests and speaking tests respectively. Before each test, "Today's Scene" was shown to the subjects. After finishing the second speaking test, the subjects were asked to fill out the post-hoc questionnaire to indicate their impression about the CALL study. This procedure was repeated three times, covering one lesson at a time.
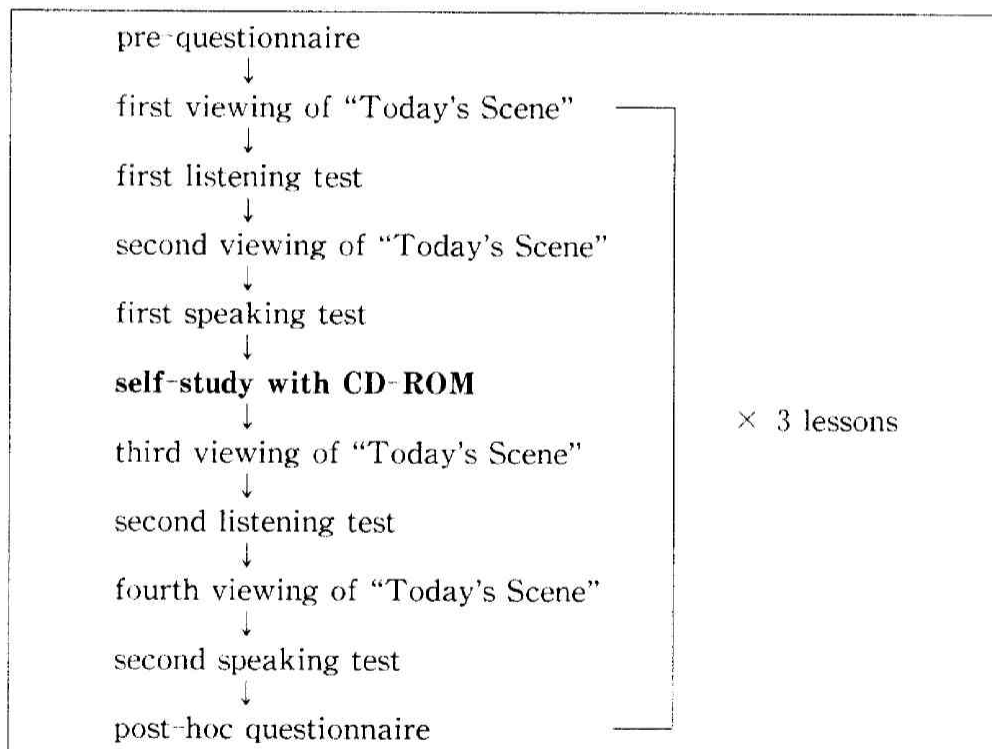
```
pre-questionnaire
        ↓
first viewing of "Today's Scene"  ─────┐
        ↓                              │
first listening test                   │
        ↓                              │
second viewing of "Today's Scene"      │
        ↓                              │
first speaking test                    │
        ↓                              │
self-study with CD-ROM             × 3 lessons
        ↓                              │
third viewing of "Today's Scene"       │
        ↓                              │
second listening test                  │
        ↓                              │
fourth viewing of "Today's Scene"      │
        ↓                              │
second speaking test                   │
        ↓                              │
post-hoc questionnaire             ────┘
```

**Fig. 1. Procedure of the experiment**

### 3.3 Results and Discussion

Based on the data from the attitude questionnaires, the learning logs, the listening tests and the speaking protocols, four subjects were

chosen. They were contrastively analyzed in order to see if the learning effects of the CALL lesson on the users were different, and if so, then how different they were.

*Subject 1 vs. Subject 2.*

Subject 1, a high-intermediate level student, spoke well from the beginning, but her speech improved qualitatively after the CALL lesson, that is, 1) the number of key words used in her speech increased, 2) the average sentence length became longer, 3) more contextual information was embedded in her speech so that the description became clearer and more precise. On the other hand, Subject 2, a false beginner, hardly spoke in the pretests. His speech improved in terms of the text length, but not of organization and expressions. In this sense, he made a quantitative improvement in contrast to Subject 1.

Subject 1 is a returnee from the United States and is the most fluent English speaker of the group. She had strong initial interest in CALL according to her response to the presession questionnaire, and had some prior computer experience. Her positive attitude toward CALL was maintained throughout the 3 sessions.

Figure 2 shows her results of the listening tests. She showed almost perfect listening comprehension from the beginning.

However, according to her speaking test results, her vocabulary size increased and she incorporated some key words she learned from the CALL lesson in the post speaking tests (See Table 1).
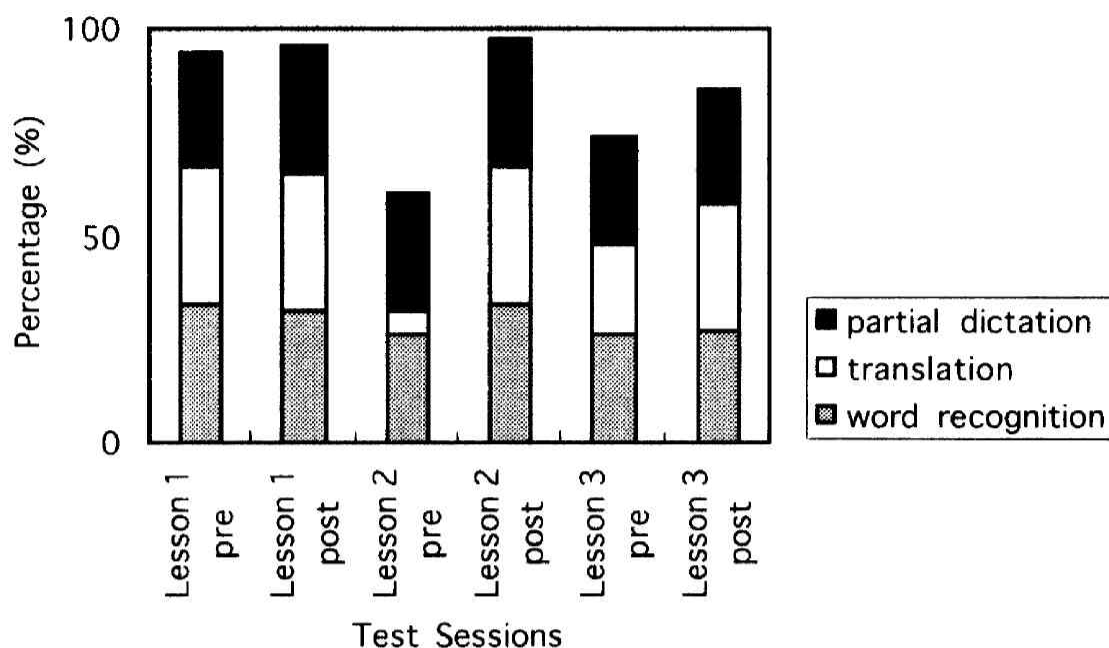
Fig. 2. Listening test results (Subject 1)

Table 1. Speaking test results (Subject 1)

|  | Lesson 1 | | Lesson 2 | | Lesson 3 | |
|  | pre | post | pre | post | pre | post |
| --- | --- | --- | --- | --- | --- | --- |
| word total | 278 | 283 | 260 | 281 | 282 | 319 |
| vocabulary size | 117 | 125 | 106 | 115 | 104 | 121 |
| no. of sentences | 30 | 30 | 19 | 21 | 23 | 26 |
| word per sentence | 9.27 | 9.43 | 13.68 | 13.38 | 12.26 | 12.27 |
| key words used | 7 | 10 | 5 | 4 | 3 | 6 |
| idea unit | 24 | 32 | 27 | 24 | 26 | 36 |

When looking at her learning process in using the CALL program,
it was found that sufficient practice in Script made it easy for her to
work with the rest of the exercises ; Vocabulary, Linguistic Compre-
hension, and Partial Dictation. This is because Script has every
important clue in order to get the right answers to those exercises.

Figure 3 shows the time spent in each CALL exercise. It also shows
the order of the exercises the subject studied. In Lesson 1, for
example, she started with Script and often clicked "Help" and "Slow
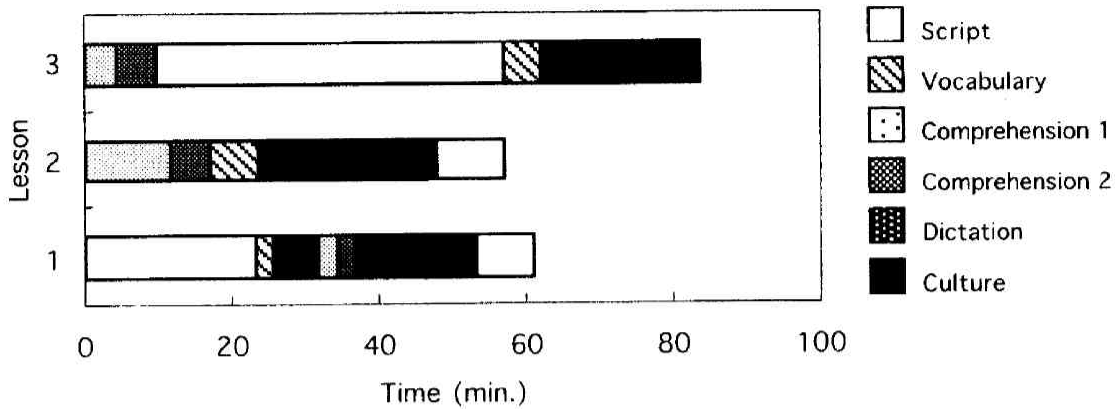English," which appeared in the log as Figure 4 shows. She used these

38



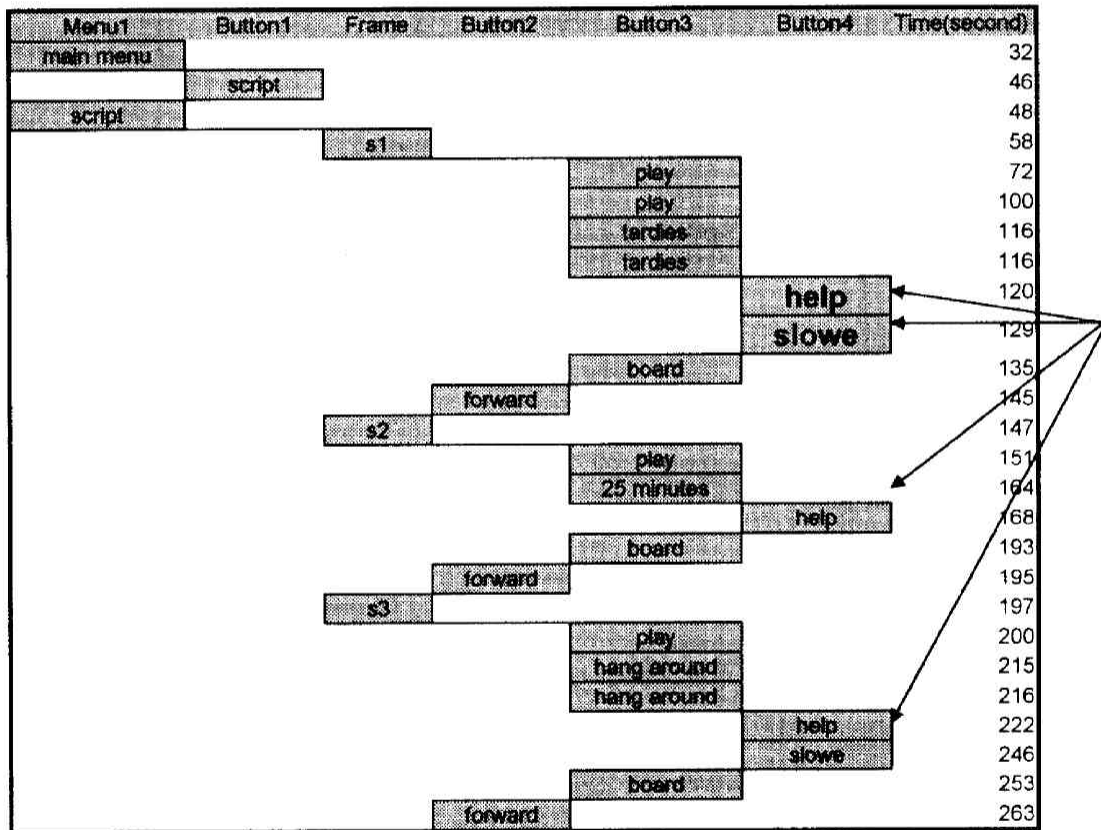Fig. 3. Time spent in each exercise on CALL (Subject 1)



Fig. 4. The learning log of *Script*, Lesson 1 (Subject 1)

function buttons in order to make sure of the meanings of the target phrases and their pronunciation.

As result, her post speech improved qualitatively. Two examples are displayed here from her speech protocols in pre- and post-tests of

Lesson 2. The following two paragraphs describe the same scene.

Pre-test (Subject 1, Lesson 2):

*When Marty came home that he found the car was wrecked. And he was seemed so helpless and he entered the house, and found Biff and his father. And they were talking about the car and seems that Biff was renting the car from Marty's father and he happen to broke the car. And he spilt the beer over the coat. And <u>Marty's father has no time to talk</u>... So he was very upset about it. And Marty's mother came in and she brought the cake and Marty's sister told Marty that Jennifer Parker called Marty. But he was not there. And she took the message for Marty. But Marty's mother didn't like the girl calling for boys. And she told how she was when she was young.*

↓

Post-test (Subject 1, Lesson 2):

*When Marty came back to home, he found the car was totally crushed. And when he entered the house, he found Biff and his father. And he was arguing about the car. And <u>Biff was complaining about he car which has blind spotting. And he told that Marty's father should have told the car has a blind spotting. But George, who is Marty's father, couldn't say anything. And could not complain about Biff's crushing the car</u>... He need the car tomorrow because he had to go to the camping with Jennifer. And after that, in the morning they were taking breakfast. And George was very ~~satisfied~~, because Marty was not playing for the dance party. And Marty's sister was ~~little angry~~ about that Jennifer called Marty when he was out twice. And Marty's mother, Lauren, is ~~not happy~~ about Jennifer called Marty. And she start to talk about how she was and how she met with George.*

The single-underlined part was elaborated in the posttest. In the pretest, she just mentioned the fact that George, Marty's father, kept

silent. In the post-test, however, she added the information describing the contrastive attitudes of Biff and George as well as their arguing points. And the adjective phrases with wave lines in the posttest show the feelings of the characters. This means that she added her interpretation as she understood the story more clearly.

Overall, people's situations, relations with others and their feelings are included in appropriate expressions in her posttests. Sentences became dynamic using structures such as relative pronouns and gerunds, so that the chronological order and cause-effect relationship between incidents became much clearer.

Subject 2 has a lower level of English proficiency. Unlike the others, he had no prior computer experience but had some initial interest in CALL. His attitude toward CALL changed in a positive way according to the questionnaire. To the statement "I was tense when using a computer" he responded "agree" in the first lesson, but "disagree" in the later lessons. And to the statement "CALL study is suitable for me", he responded "disagree" in the first session but "agree" for Lesson 2 and 3. As the sessions progressed, he seemed to get used to the computer operation and started to enjoy the new way of studying English.

Figure 5 shows the listening test results of Subject 2. He got only 10% right on the pretests, but he improved after the CALL lesson, on average to about 40% on the posttests.

As mentioned before, his initial interest in CALL was somewhat low and he did not have any prior computer experience. The record of his learning log displays some difficulties in using the CALL program.

First of all, he failed to make a file for the learning log in Lesson 1, although he received instruction with the others before the experiment. That's why there is no bar in the graph for Lesson 1 (See Fig. 6).

Second, he did not use any function buttons in the lower layer as
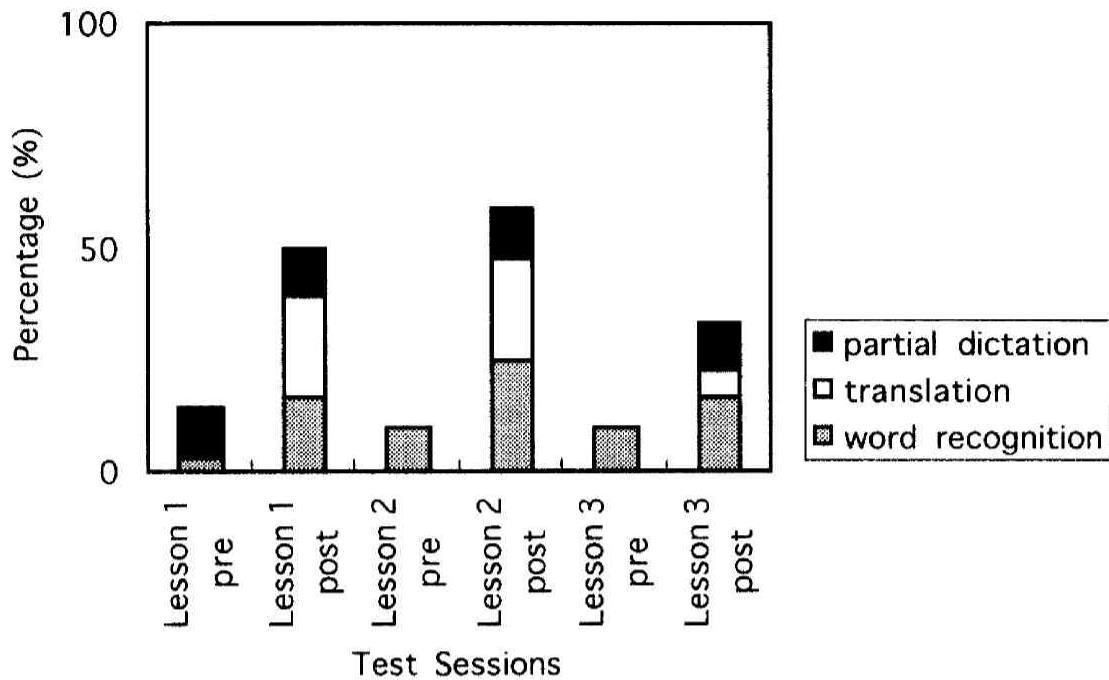
Fig. 5. Listening test results (Subject 2)
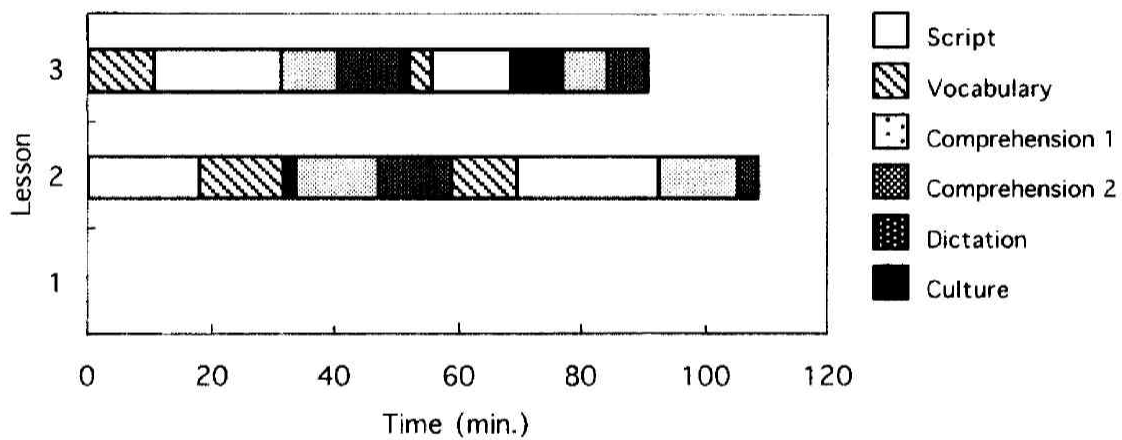


Fig. 6. Time spent in each exercise on CALL (Subject 2)

the arrow shows in Figure 7. Those functions should have benefited him for further information. He stayed at a very superficial level of the program and thus, he got through each session quickly.

"Repetition" was his strategy. He repeated some sections and in those sections, he did better on the second try than the first try. For example, in Script of Lesson 2, he only used the "Play" button repeatedly. He listened to the original sound of each page a couple of

| Menu | Button1 | Frame | Button2 | Button3 | Button4 | Time(second) |
|---|---|---|---|---|---|---|
| main menu | | | | | | 2099 |
| | usstory1 | | | | | 2100 |
| usstory1 | | | | | | 2110 |
| | | question1 | | | | 2137 |
| | | | false1 | | | 2147 |
| | | | correct | | | 2148 |
| | | | forward | | | 2183 |
| | | question2 | | | | 2184 |
| | | | true1 | | | 2191 |
| | | | wrong | | | 2192 |
| | | | forward | | | 2219 |
| | | question3 | | | | 2222 |
| | | | true1 | | | 2254 |
| | | | correct | | | 2255 |
| | | | forward | | | 2271 |
| | | question4 | | | | 2273 |
| | | | false1 | | | 2277 |
| | | | false1 | | | 2280 |
| | | | correct | | | 2281 |
| | | | forward | | | 2302 |
| | | question5 | | | | 2303 |
| | | | false1 | | | 2325 |
| | | | correct | | | 2325 |
| | | | forward | | | 2378 |
| | | question6 | | | | 2379 |
| | | | false1 | | | 2397 |
| | | | wrong | | | 2397 |
| | | | forward | | | 2424 |
| | | question7 | | | | 2427 |
| | | | true1 | | | 2454 |
| | | | correct | | | 2454 |
| | | | forward | | | 2477 |
| | | question8 | | | | 2481 |
| | | | false1 | | | 2508 |
| | | | correct | | | 2509 |
| | | | forward | | | 2569 |

Fig. 7. Learning log of *Comprehension1*, Lesson 2 (Subject 2)

times. In Vocabulary, he answered only two correctly, out of 15 questions. In spite of the low score, he did not go back to Script to find some hints for the right answers. In Comprehension, only 30% of his answer was correct. Even so, he didn't find a way of getting further information, that is, clicking Script button to go back to the relevant Script page. Then he retried Vocabulary, Script and Comprehension 1 and 2 (See Fig. 6). This time he got about 80% right. Still he didn't use the Script button. But at the very last moment, in Comprehension 1 in Lesson 3, he notices the function, which is circled in Figure 8, to get more information. In Comprehension 2 of the same lesson, now he knew the way to get more detailed information, so he started using the function whenever he needed to do it (See Fig. 9).

| Menu | Button1 | Frame | Button2 | Button3 | Button4 | Time(second) |
|---|---|---|---|---|---|---|
| main menu | | | | | | 1930 |
| | usstory | | | | | 1938 |
| usstory1 | | | | | | 1941 |
| | | question1 | | | | 1948 |
| | | | true | | | 1963 |
| | | | correct | | | 1964 |
| | | | forward | | | 1977 |
| | | question2 | | | | 1977 |
| | | | true | | | 1984 |
| | | | correct | | | 1984 |
| | | | forward | | | 1999 |
| | | question3 | | | | 2000 |
| | | | false | | | 2004 |
| | | | correct | | | 2004 |
| | | | forward | | | 2020 |
| | | question4 | | | | 2020 |
| | | | false | | | 2064 |
| | | | correct | | | 2064 |
| | | | forward | | | 2085 |
| | | question5 | | | | 2086 |
| | | | false | | | 2095 |
| | | | correct | | | 2095 |
| | | | forward | | | 2108 |
| | | question6 | | | | 2109 |
| | | | false | | | 2115 |
| | | | correct | | | 2115 |
| | | | forward | | | 2122 |
| | | question7 | | | | 2123 |
| | | | false | | | 2153 |
| | | | wrong | | | 2154 |
| | | | forward | | | 2164 |
| | | question8 | | | | 2165 |
| | | | false | | | 2180 |
| | | | wrong | | | 2180 |
| | | | script | | | 2187 |
| | s15 | | | | | 2190 |
| | | | | play | | 2194 |
| | | | previous | | | 2220 |

Fig. 8. Learning log of *Comprehension1*, Lesson 3 (Subject 2)

As for his speaking test results, he couldn't speak much in any of the pretests. What impresses most here is that the total number of words dramatically increased in the posttest ; it increased from 40 words in the pretest to 157 words in the posttest in Lesson 1, 53 words to 241 words in Lesson 2 and 90 words to 157 words in Lesson 3.

44

| Menu | Button1 | Frame | Button2 | Button3 | Button4 | Time(se cond) |
|---|---|---|---|---|---|---|
| main menu | | | | | | 4667 |
| | usstory1 | | | | | 4717 |
| usstory1 | | | | | | 4720 |
| | | question1 | | | | 4727 |
| | | | true1 | | | 4739 |
| | | | correct | | | 4740 |
| | | | forward | | | 4759 |
| | | question2 | | | | 4759 |
| | | | true1 | | | 4769 |
| | | | correct | | | 4769 |
| | | | forward | | | 4785 |
| | | question3 | | | | 4785 |
| | | | false1 | | | 4789 |
| | | | correct | | | 4789 |
| | | | forward | | | 4806 |
| | | question4 | | | | 4807 |
| | | | false1 | | | 4814 |
| | | | correct | | | 4814 |
| | | | script | | | 4827 |
| | s3 | | | | | 4830 |
| | | | | play | | 4832 |
| | | | previous | | | 4844 |
| | | | forward | | | 4855 |
| | | question5 | | | | 4856 |
| | | | false1 | | | 4859 |
| | | | correct | | | 4859 |
| | | | forward | | | 4868 |
| | | question6 | | | | 4869 |
| | | | false1 | | | 4874 |
| | | | correct | | | 4874 |
| | | | script | | | 4886 |
| | s8 | | | | | 4889 |
| | | | | play | | 4892 |
| | | | previous | | | 4917 |
| | | | forward | | | 4929 |
| | | question7 | | | | 4930 |
| | | | true1 | | | 4937 |
| | | | correct | | | 4937 |
| | | | forward | | | 4945 |
| | | question8 | | | | 4946 |
| | | | true1 | | | 4951 |
| | | | correct | | | 4951 |
| | | | script | | | 4965 |
| | s15 | | | | | 4969 |
| | | | | play | | 4974 |
| | | | forward | | | 4998 |
| | s16 | | | | | 4999 |
| | | | | play | | 5003 |
| | | | previous | | | 5014 |
| | | | forward | | | 5029 |

Fig. 9. Learning log of *Comprehension2*, Lesson 2 (Subject 2)

**Table 2. Speaking test results (Subject 2)**

|  | Lesson 1 | | Lesson 2 | | Lesson 3 | |
| --- | --- | --- | --- | --- | --- | --- |
|  | pre | post | pre | post | pre | post |
| word total | 40 | 171 | 53 | 241 | 90 | 157 |
| vocabulary size | 34 | 101 | 40 | 98 | 53 | 84 |
| no. of sentences | 6 | 27 | 5 | 23 | 17 | 16 |
| word per sentence | 6.7 | 6.3 | 10.6 | 10.5 | 5.3 | 9.8 |
| key word | 0 | 3 | 1 | 3 | 0 | 1 |
| idea unit | 5 | 19 | 6 | 22 | 11 | 22 |

*Subject 3 vs. Subject 4.*

Subject 3 and Subject 4 also form a good contrast. Their English proficiency levels were both intermediate and both of them had strong initial interest in CALL. However, as the session progressed, Subject 3 looked enjoying the CALL program and actually maintained a positive attitude toward it according to her response in the questionnaire, while Subject 4 gradually lost interest toward it since she sometimes got confused in using the buttons. Therefore, although the figures of the listening and speaking test results showed that both subjects made a similar improvement, the qualitative analyses of their speaking protocols revealed that their texts were quite different. The post-speeches of Subject 3 became well-organized and coherent, and more precisely described incidents in the story. On the other hand, the post-speeches of Subject 4 had a lot of verbatim expressions, and lacked coherence and consistency. Her speech was inconsistent in terms of too much situational descriptions in the first part and lack of contextual information in the last part.

Subject 3 showed strong initial interest in CALL and her positive attitude toward CALL was maintained throughout the sessions. Her listening test results showed a remarkable improvement in the recognition level of comprehension (See Fig. 10). She is a good example of a learner who used the CALL exercises effectively and strategically, and it is shown in her learning log. As for the speaking test, her
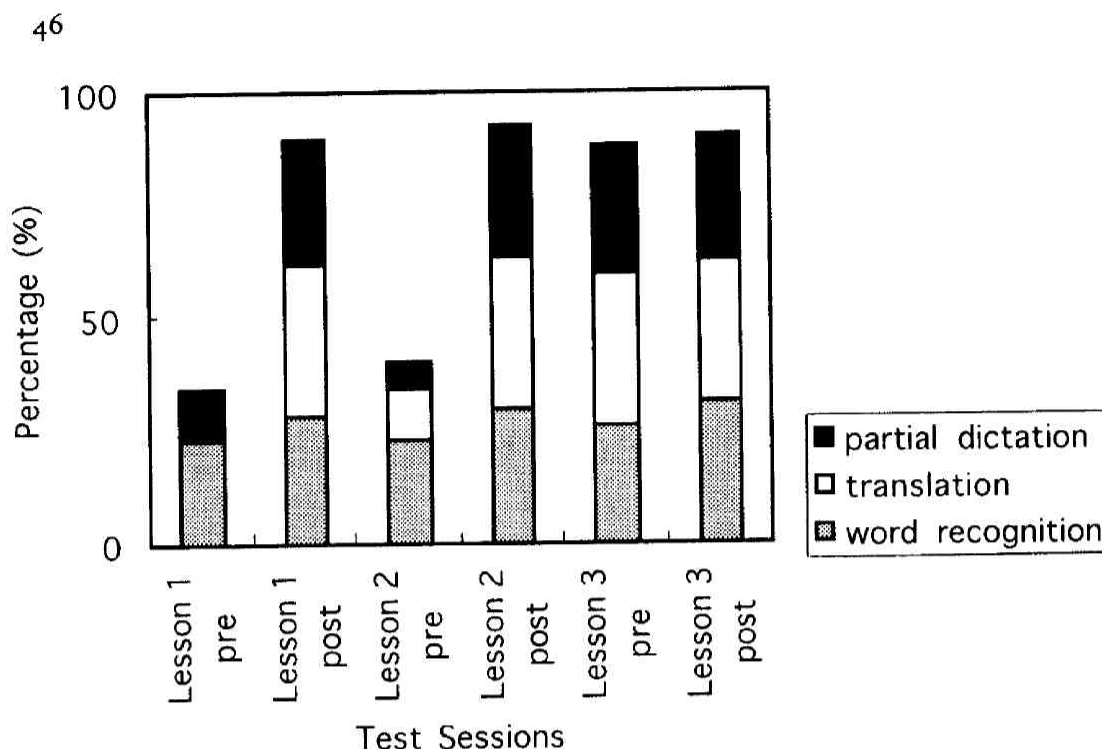
**Fig. 10. Listening test results (Subject 3)**

speech also improved after the CALL lesson.

Figure 10 shows the listening test results of Subject 3. On the recognition level, the subject was able to catch words fairly well, however, she did not do a good job on translation and partial dictation tasks in the pre-tests of Lesson 1 and Lesson 2. Her score on these tasks improved remarkably in the post-tests of both lessons, and when she started the third session, her pre-test score was much better than the other two pre-tests before. She seemed to get used to listen to authentic speech by using the CALL material effectively.

One point to note about her strategies in the CALL lesson is her effective use of "Script" (See Fig. 11). In Lesson 1, she first studied Script carefully and then went to the other exercises. She listened to the original sound in each page a couple of times as shown by the circles in Figure 12, so that she got used to the speaking speed in the scene as well as the meanings of the phrases studied in Script. She also practiced the expressions orally by "Slow English". She returned to Script to check the answers in Vocabulary in all three lessons (See
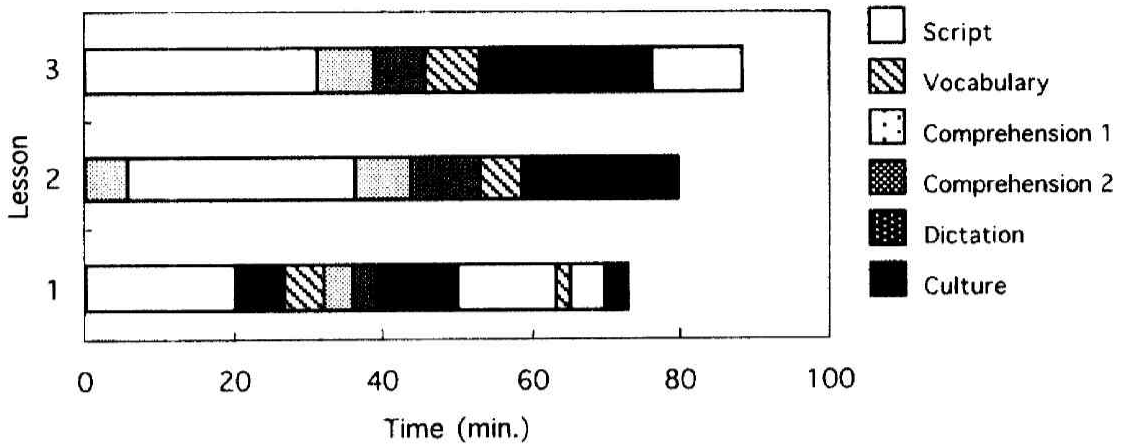
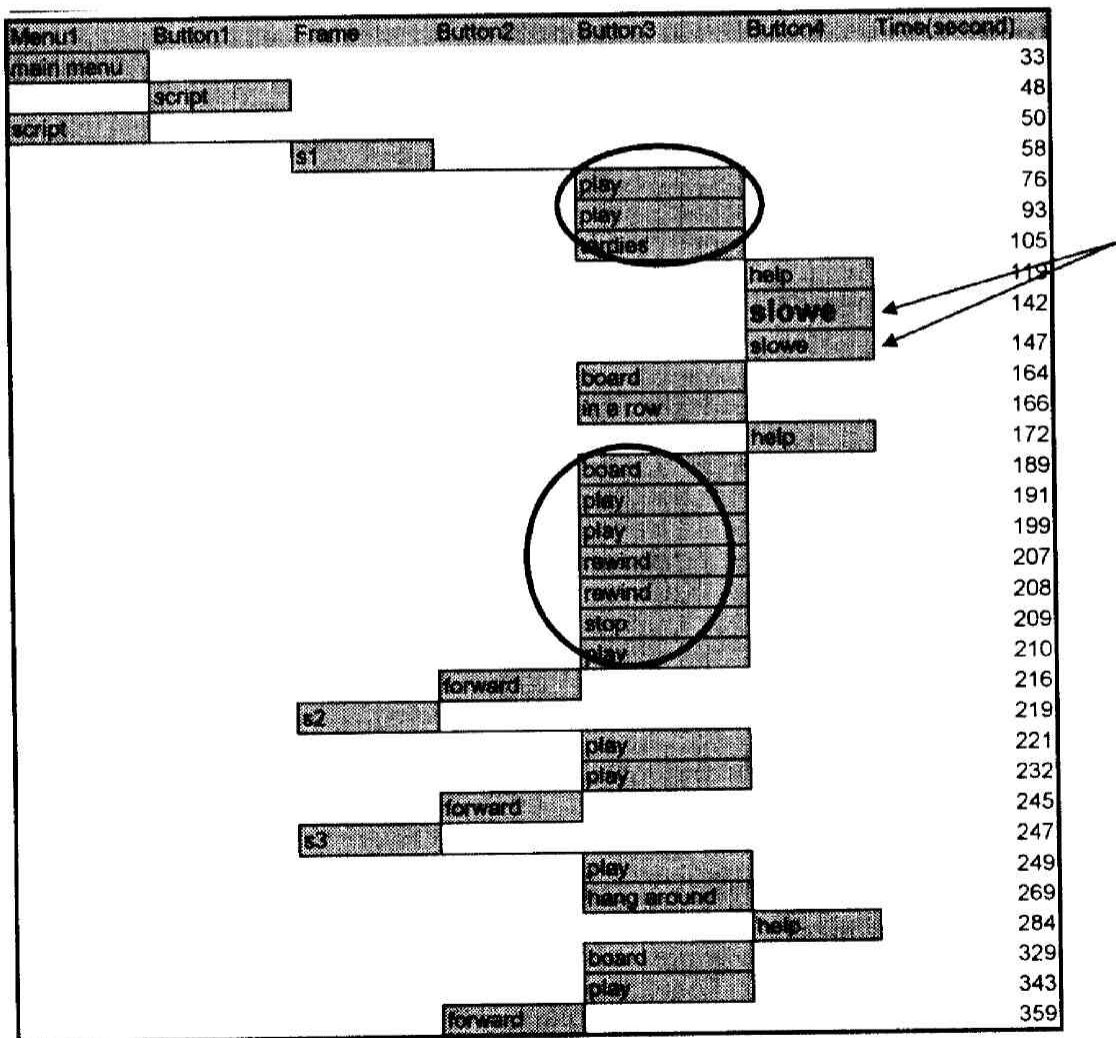**Fig. 11. Time spent in each exercise on CALL (Subject 3)**



**Fig. 12. Learning log of *Script*, Lesson 1 (Subject 3)**

Fig. 13). She was aware of the effective way of using the information in Script from the beginning.

For example, in Lesson 2, she started with Comprehension exercise but she got just 8 questions right out of 15. So she didn't go to the second set of Comprehension exercises, and instead she went to Script (See Fig. 11). She thoroughly studied each page of the Script by looking up the key words and listening to the sounds. Then she tried Comprehension 1 again. This time she got all the answers correct and jumped to "Script" only twice during the exercise. Then she went on to Comprehension 2, Vocabulary, and Partial Dictation. She didn't make any mistakes in those exercises.

The effective learning in the CALL lesson reflected her post speech. For example, in the first part of her pre-speech about Lesson 1, the sentences are choppy. But in the post-test, the same part sounded much more coherent. One thing is that she formed a compound sentence to show the relationship of the incidents.

Pre-test (Subject 3, Lesson 1)

*Marty was late for school. He was leaving hurry up. He went to school with skateboard. And when he arrive at the school, Jennifer was waiting for him. And the day was band audition's day, so Marty shouldn't late for.*

↓

Post-test (Subject 3, Lesson 1)

*Marty will be late for school again, so he go to school hurry with skateboard. When he arrived at school, his girlfriend Jennifer is waiting for him. And she find another way to go to classroom not to meet Mr. Strickland.*

The numbers of words spoken between the post-test and the pre-test were also different (See Table 3).

| Menu1 | Button1 | Frame | Button2 | Button3 | Button4 | Time(second) |
|---|---|---|---|---|---|---|
| main menu | | | | | | 1680 |
| | vocabularym | | | | | 1682 |
| vocabulary | | | | | | 1684 |
| | | q1 | | | | 1715 |
| | | | | late | | 1717 |
| | | | correct | | | 1717 |
| | | | scriptb | | | 1724 |
| | | s1 | | | | 1730 |
| | | | previous | | | 1737 |
| | | | baloon1 | | | 1748 |
| | | | forward | | | 1774 |
| | | q2 | | | | 1774 |
| | | | | a little | | 1782 |
| | | | correct | | | 1782 |
| | | | baloon2 | | | 1786 |
| | | | scriptb | | | 1791 |
| | | s4 | | | | 1795 |
| | | | previous | | | 1801 |
| | | | forward | | | 1806 |
| | | q3 | | | | 1807 |
| | | | | crazy | | 1816 |
| | | | correct | | | 1816 |
| | | | scriptb | | | 1819 |
| | | s4 | | | | 1823 |
| | | | | nut case | | 1830 |
| | | | | nut case | | 1834 |
| | | | previous | | | 1838 |
| | | | forward | | | 1848 |
| | | q4 | | | | 1849 |
| | | | | tricky | | 1859 |
| | | | wrong | | | 1859 |
| | | | | lazy | | 1861 |
| | | | correct | | | 1861 |
| | | | scriptb | | | 1865 |
| | | s5 | | | | 1870 |
| | | | | attitude problem | | 1873 |
| | | | backward | | | 1878 |
| | | s4 | | | | 1879 |
| | | | previous | | | 1880 |
| | | | forward | | | 1885 |
| | | q5 | | | | 1886 |
| | | | | upset | | 1896 |
| | | | correct | | | 1897 |
| | | | scriptb | | | 1901 |
| | | s18 | | | | 1906 |
| | | | | my mother freak | | 1910 |
| | | | | | slowe | 1920 |
| | | | previous | | | 1932 |
| | | | forward | | | 1938 |

Fig. 13. Learning log of *Vocabulary*, Lesson 1 (Subject 3)

**Table 3. Speaking test results (Subject 3)**

|  | Lesson 1 | | Lesson 2 | | Lesson 3 | |
|---|---|---|---|---|---|---|
|  | pre | post | pre | post | pre | post |
| word total | 188 | 275 | 138 | 353 | 318 | 421 |
| vocabulary size | 106 | 139 | 79 | 175 | 144 | 183 |
| no. of sentences | 15 | 23 | 14 | 26 | 31 | 38 |
| words per sentence | 12.5 | 12.0 | 9.9 | 13.6 | 10.3 | 11.1 |
| key words | 3 | 12 | 2 | 8 | 0 | 8 |
| idea units | 21 | 34 | 15 | 40 | 38 | 47 |

Moreover, she added phrases which she had studied in Partial Dictation of the CALL lesson. The underlined sentences are almost the same as what she learned in Partial Dictation in Lesson 2. This part isn't seen in the pre-test. She seemed to have memorized them through the exercises in CALL.

Pre-test (Subject 3, Lesson 2)

*At dinner, family gathered in the dining, and they were talking. And Marty's mother came with cake and she said, we are going to have to eat this cake by ourselves. Because that cake was for Uncle Joey was in prison, so they had to eat by themselves.*

↓

Post-test (Subject 3, Lesson 2)

*At the dinner table, everyone gathered there, and mother, Lorraine came there with cakes and said to them we had to eat this cake by ourselves because Uncle Joey couldn't parole so we can't celebrate. And Lorraine asked them to write letters to Uncle Joey but they didn't want to write⋯*

*Then Lorraine started to talk about the time when George and Lorraine meet for the first time. They are tired listening to story of what happened young George and Lorraine, but Lorraine talk. Thirty years ago, Lorraine's father hit George with car and Lorraine's father*

*brought him into the house and then they met for the first time. And*
*they went to her school dance party, and kissed. Then Lorraine realize*
*that the rest of her life with him.*

Subject 4, in contrast, exemplified that CALL does not always
affect learners positively. She had strong initial interest in CALL and
had some computer experience prior to this experiment. However, as
the session progresses, her attitude toward CALL changed in a
negative way. To the post-hoc questionnaire statement "I felt the
need of textbooks and handouts", she responded "disagree" in the
first lesson, but after the second and third lesson, her reaction
changed to "agree". Also, to the statement "CALL study is suitable
for me" she responded "agree" in the first lesson, but after the second
and third, she changed to "disagree". In the last questionnaire she
wrote her comment "I'm accustomed to memorize (she used the
Japanese word "oboeru") English by writing, so I don't think I could
memorize English with a computer." From these comments, it is
predicted that she thinks studying English equals memorizing the
words and phrases. This prediction was proved by the analyses of her
learning strategies in working with this CALL.

It is noted, first of all, that she spent a lot of time on Script (See
Fig. 15). The second point is that she sometimes got confused in using
the program, which rather interfered with her learning. As she
confessed in the questionnaire, she preferred studying English by
pencil and paper, so that she couldn't gain knowledge or skills
sufficiently through the exercises in CALL.

In Lesson 1, she first studies Script carefully. In every page, she
orally practiced the lines by repeating the "Slow English" sound.
After studying all 24 pages, she tried to go back to the main menu.
But it seems that it wasn't easy for her. She awkwardly used Next
and Previous arrow buttons to go back to the first page of the Script.
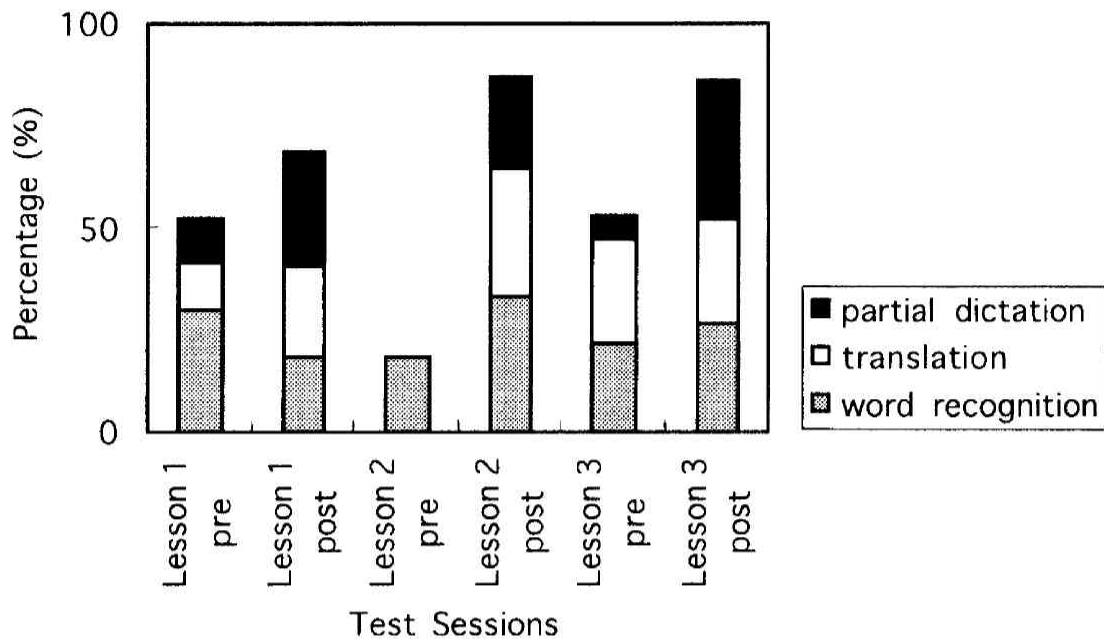It took her almost 2 minutes and 40 seconds to go back to the main
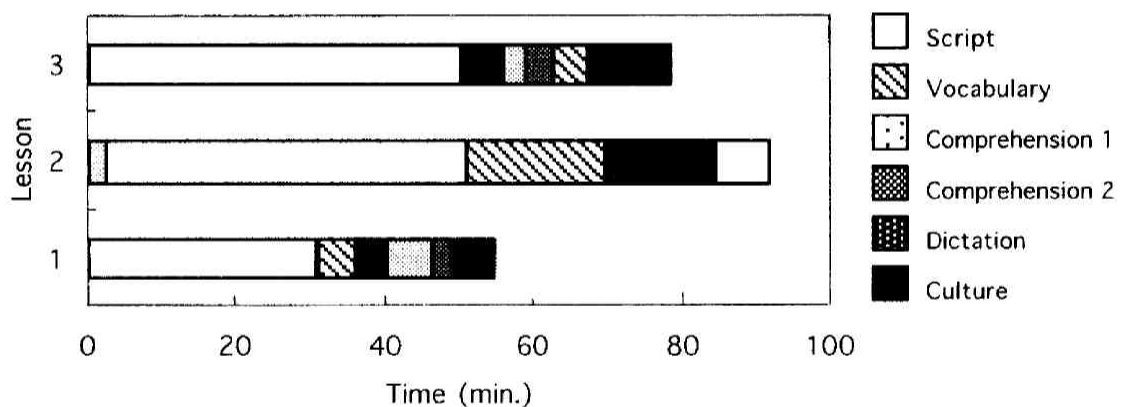
Fig. 14. Listening test results (Subject 4)



Fig. 15. Time spent on each exercise in CALL (Subject 4)

menu. When she worked with Comprehension and tried to look up some clues for the right answers in Script, she didn't get out of Script to go back to Comprehension 1. This is probably because she could not find a way to return to the same page of Comprehension 1 easily (See Fig. 16). Then she chose Culture, but soon gave it up and went to Vocabulary (See Fig. 15). After getting into Vocabulary, she often referred to Script as shown in Figure 17. She looked back at a couple

| Menu | Button1 | Frame | Button2 | Button3 | Button4 | Time(second) |
|---|---|---|---|---|---|---|
| opening | | | | | | 0 |
| title | | | | | | 19 |
| main menu | | | | | | 33 |
| | usstory 1 | | | | | 39 |
| usstory1 | | | | | | 48 |
| | | question1 | | | | 73 |
| | | | false | | | 83 |
| | | | correct | | | 84 |
| | | | forward | | | 100 |
| | | question 2 | | | | 101 |
| | | | true | | | 117 |
| | | | wrong | | | 117 |
| | | | forward | | | 134 |
| | | question 3 | | | | 137 |
| | | | true | | | 168 |
| | | | correct | | | 168 |
| | | | script | | | 179 |
| | | s3 | | | | 198 |
| | | | forward | | | 250 |
| | | s4 | | | | 252 |
| | | | forward | | | 285 |
| | | s5 | | | | 288 |
| | | | | figured | | 295 |
| | | | | | slowe | 303 |
| | | | previous | | | 309 |
| | | | script | | | 340 |
| | | s3 | | | | 354 |
| | | | | rewind | | 382 |
| | | | | there | | 392 |
| | | | backward | | | 438 |

Fig. 16. **Learning log of** *Comprehension1*, **Lesson 2 (Subject 3)**

of pages in Script for each question in Vocabulary. It seemed that she learned and tried to memorize pieces of information. She actually took notes for some words and phrases.

Her speech improved in terms of two figures; vocabulary size, which is the number of different words used in her speech, and the number of key words learned in CALL included in her speech (See Table 4). It means she obviously spoke much more with more details in the post-speaking test.

| Menu1 | Button1 | Frame | Button2 | Button3 | Button4 | Time(second) |
|---|---|---|---|---|---|---|
| main menu | | | | | | 3098 |
| | words | | | | | 3101 |
| words | | | | | | 3104 |
| | | question1 | | | | 3140 |
| | | | | area | | 3146 |
| | | | correct | | | 3147 |
| | | | scriptb | | | 3156 |
| | | s2 | | | | 3177 |
| | | | previous | | | 3217 |
| | | | forward | | | 3228 |
| | | question2 | | | | 3231 |
| | | | | bring | | 3254 |
| | | | correct | | | 3255 |
| | | | scriptb | | | 3262 |
| | | s7 | | | | 3282 |
| | | | forward | | | 3306 |
| | | s8 | | | | 3311 |
| | | | previous | | | 3329 |
| | | | forward | | | 3339 |
| | | question3 | | | | 3341 |
| | | | | easily | | 3359 |
| | | | correct | | | 3360 |
| | | | scriptb | | | 3375 |
| | | s8 | | | | 3392 |
| | | | previous | | | 3402 |
| | | | forward | | | 3412 |

Fig. 17. Learning log of *Vocabulary*, Lesson 2 (Subject 4)

Table 4. Speaking test results (Subject 4)

| | Lesson 1 | | Lesson 2 | | Lesson 3 | |
|---|---|---|---|---|---|---|
| | pre | post | pre | post | pre | post |
| word total | 315 | 385 | 241 | 385 | 428 | 497 |
| vocabulary size | 130 | 175 | 109 | 168 | 146 | 191 |
| no. of sentences | 21 | 36 | 20 | 32 | 41 | 43 |
| words per sentence | 15.0 | 10.7 | 12.2 | 12.0 | 10.4 | 11.6 |
| key words | 1 | 9 | 3 | 12 | 1 | 4 |
| idea units | 19 | 40 | 25 | 35 | 41 | 51 |

The qualitative analyses of the protocols, however, revealed some problems in the aspect of organization and coherence of the paragraphs. The first point is that she finely describes what she has seen

in the scene, even including the minute details at the beginning; however, as her speech goes on, gradually such detailed description disappears as though she was getting exhausted. The comparison between the first six lines and the last two of the protocol of the pre-speaking test in Lesson 1 demonstrates it clearly as follows.

Pre-test (Subject 4, Lesson 1):

*A man came from the fence with skateboard and he went outside and he found a truck. Then he catch the truck and the truck is running. And he catch the back of the truck and he go ahead in the street and then he sometimes wave his hand to a lot of dancers in the building. And then he continue to grab the back of truck. And he turned right and he changed another truck and at last he arrived at his college.*

↓

*And after that a car came here. The driver is his girlfriend's father. And she said, father is here, I must go.*

↓

Post-test (Subject 4, Lesson 1):

*After that one car came here. And the driver is Jennifer's father. So she must go. Then Marty said, I'll call tonight. Then she said, I'll let you know, I'll give you my telephone number. Tonight I'll go to grandmother's house.*

In the posttest of Lesson 1, she included more details such as who is talking to whom. For instance, as the underlined part shows, she only said these two lines in the pretest. But the same scene was described more precisely in the posttest. She actually spoke more words than the pretest (See Table 4). Another problem of her speech was that however, she frequently used direct speech form using exactly the same expressions as the ones in the scene. Here is the excerpt of the speech in the post-test in Lesson 2. The first and

second-person pronouns are seen here.

Post-test (Subject 4, Lesson 2)

*There are two person. One is his father, George, and other is Giff. And they are talking about the car, the broken car. And George said, your insurance is going to pay for the damage. But Giff said, my jacket is get dirty. Who is going to pay for cleaning bill? And Giff do bad thing against Marty's father and attack his head for many times.*

In this way her way of speaking was quite verbatim. This tendency was seen throughout her speech. As a result, it was impressed that her speech lacks coherence and it was hard to understand the main point or the outline of the story.

### 4. Conclusion

As those four subjects exemplified, we found that there were individual differences in the effect of CALL even though they used the same program.

Observing their differences in the aspect of cognition or information-processing, it seems that Subject 3 acquired appropriate knowledge to decrease the burden of bottom-up processing as a result of efficient learning of CALL. That is, her attention to choose and use words and phrases in her speech was lessened. Thus top-down processing was facilitated, which meant she could think about the structure of her speech at a macro level. This enabled her to organize the text better and to add more precise information.

Subject 4 in this sense, had too much burden on bottom-up processing, which interfered with her top-down processing. Her speech gave us an impression that she simply picked up the phrases she had learned in CALL, formed sentences with them, and put those sentences together into a paragraph. It seemed that she couldn't see the text structure of her speech at macro level, thus missed a main point

and necessary information to make the story clear.

The information-processing approach also explains that Subject 1 and 2 had some improvement in their speech but their types of improvement were different in the levels of comprehension depth. Subject 1 elaborated the expressions and the organizations of her speech after the CALL lesson, that is, her speech made a qualitative improvement. On the other hand, Subject 2 increased the number of words he spoke after the CALL lesson. This type of quantitative improvement implies that his level of comprehension process is more superficial than that of Subject 1.

What made Subject 1 and 2 different and Subject 3 and 4 different in their learning processes with CALL? We think it is somewhat related to "interactivity" in working with computer programs. But nothing is clear right now. It will be explored in the future direction of our research.

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## Appendix A

### Attitude Questionnaire

コンピュータ学習について印象的に評価してください。( )に○か×を入れて下さい。

1. ゲーム感覚で気軽に取り組めてよかった。( )
2. 教科書やプリントがないと不安で勉強しにくかった。( )
3. コンピュータを利用したので緊張してしまった。( )
4. コンピュータでの英語学習はおもしろいので，もっと続けたかった。( )
5. コンピュータを使ってなら嫌いな英語も好きになれると思った。( )
6. コンピュータの操作がむずかしかった。( )
7. 英語の勉強をしている感じがしなくて，物足りなかった。( )
8. 自分の使い方が正しいのか時々不安になった。( )
9. 何をどこまで勉強したのか，実感がない感じがした。( )
10. 自分のベースで勉強するので他の人の進度が気にならなかった。( )
11. いくらコンピュータで勉強しても英語は上達しないと思った。( )
12. ネイティブの先生に習う英会話のほうがもっと面白いと思う。( )
13. コンピュータで勉強する方法は自分に合っていると思った。( )

## Appendix B

### A sample of Listening Test

*Lesson 1: History is going to change*
Comprehension Test 1

学科 (      ) 学年 (      ) 学籍番号 (      ) 氏名 (      )

Ⅰ. 単語を聞き取るテストをします。同じシーンが3回流れます。一回目は，モニターでよくシーンを見て下さい。二回目は，問題を見ながら音声を聞き，どの箇所を容れればよいか確認して下さい。最後に，

もう一度聞いて空白に書き入れてください。

1. You know, this time, it wasn't my fault. Doc set all his (　　) twenty-five minutes slow.
2. You've got a real (　　) problem, McFly! You're a slacker!
3. You don't have a (　　). You're too much like (　　) old man.
4. Reelect Mayor Goldie Wilson. Progress is his (　　) name.
5. At least, he's letting you (　　) the car tomorrow night.
6. I think the woman was (　　) a nun.
7. Some day. Wouldn't (　　) be great…to take that truck up to the (　　)?
8. She's just trying to keep you (　　).

II. 今度は，空白に日本語の意味を入れて下さい。I.と同じように，各問題のシーンが3回流れますので，同じ方法で空白に日本語を書いて下さい。

1. The Doc? Am I to understand (
　　　　　　　　　), McFly?
2. Can I go now, Mr. Strickland?
( 　　　　　　　　　　　　　　　 ). Why even bother, McFly? You don't have a chance.
3. Marty, one rejection isn't the end of the world.
Naw, ( 　　　　　　　　　　 ).
But you're good, Marty. You're really good.

III. 今度は，比較的長いフレーズの英語をそのまま書き取って下さい。音でなく，意味で聞くように心掛けないと覚えてられませんよ。ここの問題のシーンも，I.と同じように3回流れますので，同じ方法で進めて下さい。

1. Strickland is looking for you. If you get caught, it'll be
(　　　　　　　　　　　　　).
2. My mother would freak out if she knew (
　　　　　　　　　) and I'd get the standard lecture about…how she never did that kind of stuff when she was a kid.

3 . I've got to go.

    (                         ).

    I'll be at my Granma's.