THE DEVELOPMENT OF A MULTI-MEDIA LEARNING PACKAGE COMPOSED OF EDUCATIONAL TELEVISION AND SIMULATED CD-ROM

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Summary

This study was a trial for developing a multi-media learning package which combines a broadcasting program with other media. NHK School Broadcasting Special Series, "Hearing a Story – Totto-chan –", was chosen for the study, and a learning system incorporating it was constructed. A personal computer connected to simulated CD-ROM was selected as the medium for making maximum use of the strengths and for compensating for the weaknesses of the TV program, which is to improve students' listening ability. A CAI system for producing optimal learning was developed, and its effects were validated.

I. BACKGROUND

1. Multi-Media Learning Package

School broadcast English programs have been widely used, because of the advantages of enabling students to listen to the pronunciation of native speakers, or increasing student motivation. On the other hand, their educational disadvantages are clear. They cannot provide students with the knowledge of results or give enough repetition, nor can they be adapted to the ability of each student. Recently, multi-media learning packages including broadcasting programs have been proposed as a means of compensating for these disadvantages.

In order to construct a multi-media learning package, the media to be used must be decided on first. In this study, a personal computer connected to CD-ROM was selected as the medium to be combined with a TV program.

2. CD-ROM

CD-ROM, an abbreviation of "Compact Disc Read-Only Memory", is a relatively new medium. CD (for music use), which was sold for the first time in the fall of 1982, now has a higher production rate than LP records. This CD was developed into CD-ROM by application of ROM as data storage for read-only memory.

CD-ROM can hold a great deal of information. For example, Gloria's Encyclopedia in the U.S. consisting of 21 volumes (about nine million words) is stored in a CD-ROM, which is a disc with a 12-centimeter diameter and is a mere 1.2 millimeters thick, and is now on the market. Only literal information is included here. However, the capacity of a disc is vast. Presentation of pictures or sounds is easily accomplished, and even the presentation of motion pictures is possible. A disc can store the equivalent of 675 thousands manuscript pages of 400 letters (270 million letters) in Japanese. Disks of "Kojien" (The Dictionary of Classical Chinese Characters published by Iwanami Shoten), "CD Town Page" (a telephone directory by NTT), "Phonograph Records Index" (by Nichigai Associates), and other dictionaries were published, and the publication is increasing.

All information is stored in digital form, and can be readily and randomly accessed and processed with a computer. In this sense, CD-ROM can be considered as an interactive medium. Other benefits of CD-ROM are its low cost and durability. In addition, from an educational viewpoint, its function of presenting sounds and images at the same time is invaluable. This enables the CAI system to deal with sounds, which is desirable for language learning, especially foreign language learning. This function of explaining with both

images and sounds can be applied to the learning of any subject. However, it is essential for foreign language learning, which demands the learning of sounds themselves.

II. PURPOSE

The purposes of this study are described as follows:

1. To develop a more effective learning system which combines educational television with other media, and
2. To validate the effects of the learning system.

III. METHOD OF DEVELOPING THE LEARNING SYSTEM

1. Learning Objectives, Evaluation, and Subjects

First, the objectives of the system, or the expected learning outcomes of the students) were clarified for the basis of the development of the system. Since the TV program, "Hearing a Story – Totto-chan –" constitutes the center of the system, the learning objectives were based on the aim of the program. That is, as is obvious from the title, to improve listening ability. This can be divided into the following three points:

1) Students are able to listen to the correct pronunciation of native speakers of English.
2) Students are able to understand the content of the story only by listening to it.
3) Students are able to understand the meaning of each word.

Achievement of each of these objectives was measured as follows: 1) listening was measured by dictation, 2) comprehension of the content was measured by true or false questions, 3) understanding of the words was measured by translations from English to Japanese.

Upon the report of the Regional Advisory Committee of School Broadcasting, which stated that upper grade students of junior high school who watched this TV program found it rather difficult, it was decided to use students in their first year in high school as subjects of this system.

2. Preliminary Study

A preliminary study was conducted on 90 male students in their first year of high school in January, 1988. The purpose of the study was to obtain data for the development of the learning system. The students were asked to watch "Lesson 4: From the Sea and from the Land" from "Hearing a Story – Totto-chan –". The effects of program viewing were measured in terms of listening, vocabulary comprehension, and comprehension of the content.

The results are shown in Tables 1 through 3.

Table 1. Listening Test (20)

	Mean	SD
Pretest	17.11	2.08
Posttest	18.90	1.37

Table 2. Vocabulary Test (15)

	Mean	SD
Pretest	12.73	1.31
Posttest	14.18	0.90

Table 3. Comprehension Test (10)

Mean	SD
7.12	1.84

The result of the t-test of means shows that posttest scores were significantly higher than pretest scores at the 1% level in both listening and vocabulary tests. However, individual differences were found, and the lowest scores of both posttests were rather low; (listening: 13 correct out of 20; vocabulary: 11

correct out of 15). This indicates that for some students, only viewing the program was insufficient for adequate understanding. In addition, close examination of each question reveals that some words were difficult for students to catch or to remember. For example, linked words such as 'of earth' tended to cause difficulties for students. These findings suggest the necessity of system tailored to learners of various abilities.

According to comments of students after watching the program, many of them seemed to concentrate their attention too much on catching the pronunciation of native speakers to understand the whole story. At the beginning level, information about vocabulary, expression, and an outline of the story given prior to listening would be useful for better comprehension.

3. Development of the Learning System

1) Hardware

The aim of the learning system is the same as that of the TV program; to improve listening ability of pupils. After consideration of the results of the preliminary study and prior research, a personal computer connected to CD-ROM was selected as the medium to be combined with the TV program. CD-ROM, with its various advantages stated in the first part of this paper, was considered the most appropriate medium to present individual listening drills repeatedly. However, CD-ROM for educational use is still at the developmental stage, and the writing of the new information onto CD-ROM is still very expensive. Thus, TV-photograph interface (TV-Photo) and natural voice board was used instead. This system is considered to be a simulated CD-ROM in terms of educational function.

The system was constructed as shown in Figure 1. This simulates the functions of CD-ROM, which are expected to be utilized in foreign language learning in the near future. The function of each machine is as follows:

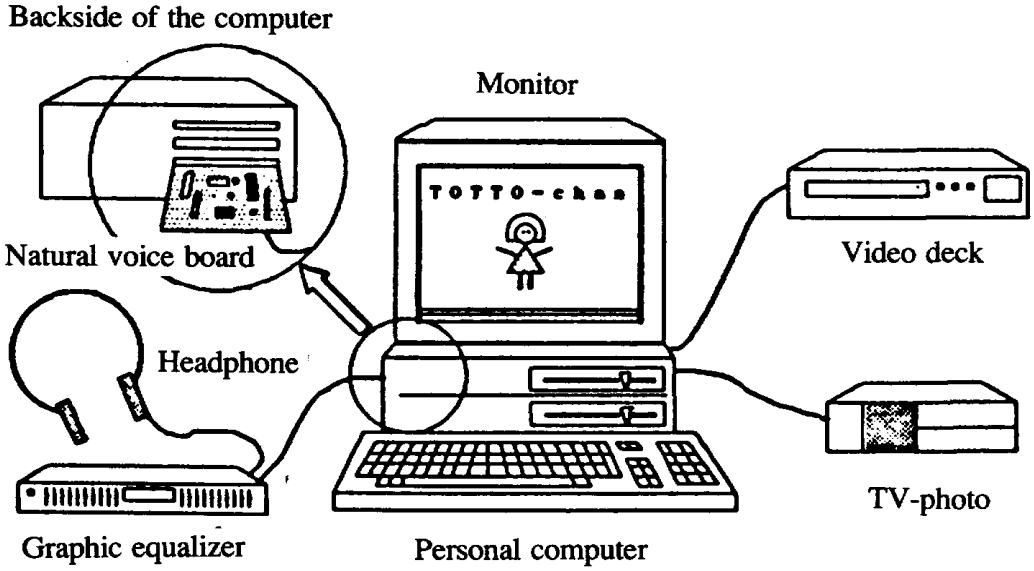

Fig. 1. System for This Study

(a) TV-Photograph interface (FUJIX IF-TV3000): With the function of playing back visual images by means of random accessing. It records still pictures taken by conventional cameras into floppy disks and plays back onto video display. It has the capacity of recording 50 frames of clear pictures onto one floppy disk, and is connected to computer via parallel interfacing board. It enables random access by simple commands in the program.

(b) Video deck: With the function of presenting motion pictures (TV programs).

(c) Natural voice board ("Oshaberikun", or "Chatterbox"): With the function of playing back voices by means of random accessing. It enables processing voice signals in computer memory by inserting this board into the expansion slots which are located on the backside of the computer chassis. Voices have been recorded onto floppy disks by means of the software which is supplied with the natural voice board by microphone, or line level input (similar to audio tape recording). It enables a single floppy disk to record voice signals for about two and a half minutes.

(d) Graphic equalizer: With the function of reducing noises in recorded voice.

(e) Personal computer: With the function of controlling the entire study.

2) Program for the development of learning materials

(a) Making of character data files: Learning materials of program consist of video software, character data, voice signal data, and video software, character data, voice signal data, and video data. In the preparation of dictionary items, for simplifying data input, the word processing program ("Matu 85") has been used. For inputting coordinates to underline the items a program which inputs the numbers into the files by only setting the beginning and ending while looking at the display has been developed and used. This utility program has been programmed with no restriction in the number of questions it can receive, and can also be used by those with no previous knowledge of BASIC program.

(b) Making of voice data files: Primarily, voices are recorded on audio tape. After modifying its frequency profile to improve signal quality via graphic equalizer, voices are recorded onto floppy disks by the software which is supplied with a natural voice board. To use this software, some experience is necessary, and the data files must be prepared by an experienced person.

(c) Making of video data files: Taking pictures by connecting a video camera to TV-Photo is a relatively simple process. However, for this system, close-up photographs were taken by a conventional camera and sent to the service center for development.

3) Software, or Courseware

The courseware of the system is shown in Figure 2.

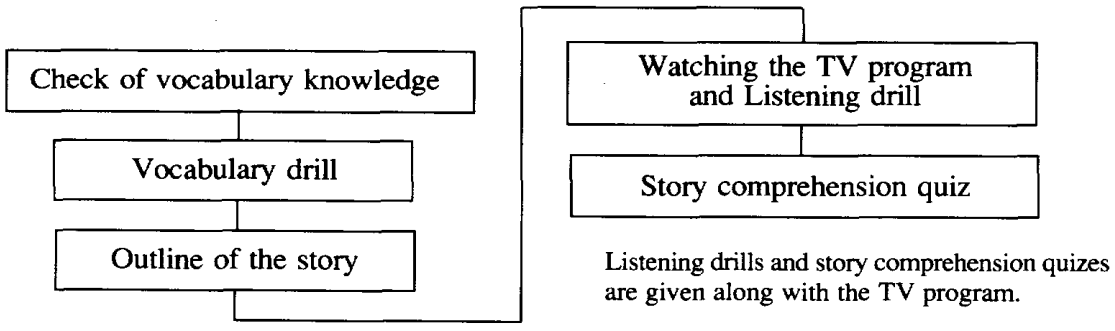

Fig. 2. Courseware of the Learning System

(a) Check of vocabulary knowledge: This part tests the learners' knowledge of words and expressions which will appear in the TV program. In this study, ten words and expressions necessary for comprehension of the story were selected upon the preliminary study, and multiple-choice questions including the answer "Unsure" were asked. When a learner answers incorrectly, immediate feedback is presented explaining why the answer is wrong (Figs. 3 and 4). In addition, "dictionary function" is provided for

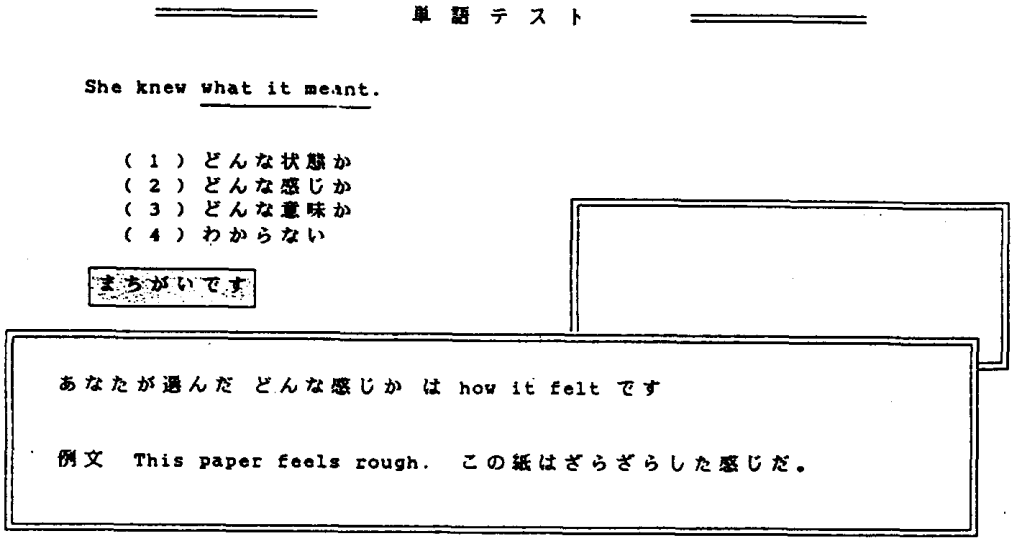

Fig. 3. Feedback to the Wrong Answer

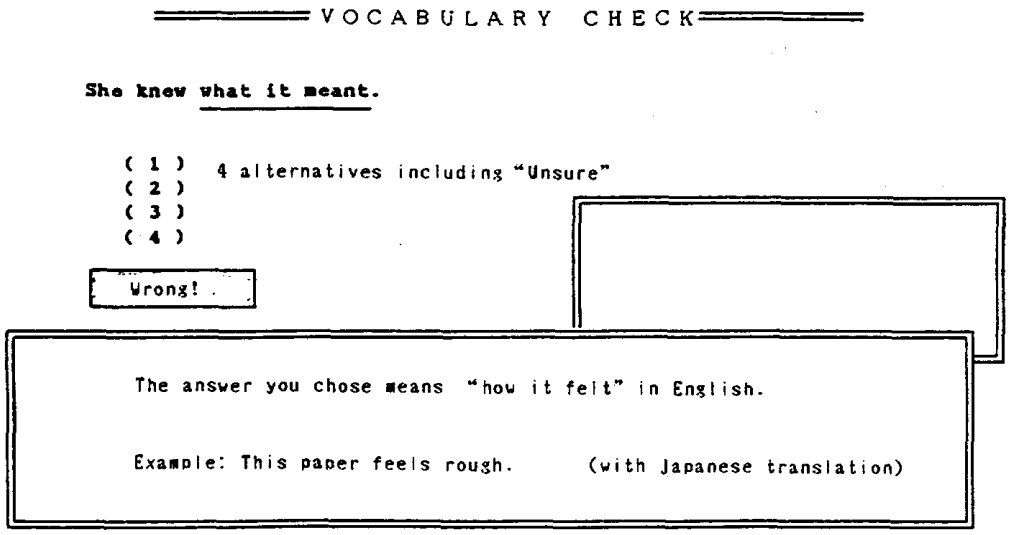

Fig. 4. Explanation of Fig. 3

each word or expression so that the learner can look at their meaning and some examples of their usage.

(b) Vocabulary drill: A vocabulary drill is required only for any word or expression where the learner made a mistake. This helps the learner grasp the correct meaning of the words. The content and style of presentation in this drill is the same as that of the Check of Vocabulary Knowledge. Drills are given twice. Any vocabulary word a learner was not able to remember in both drills is printed out with its "Dictionary", in order to draw his attention to it.

(c) Outline of the story: This part is presented in Japanese with pictures (Fig. 4) so that the learner can understand the outline of the story which he will be listening to in English Sound is presented by use of a tape recorder, and pictures by TV-photo. The summary of Lesson 1 through 4 is explained in about 3 minutes.

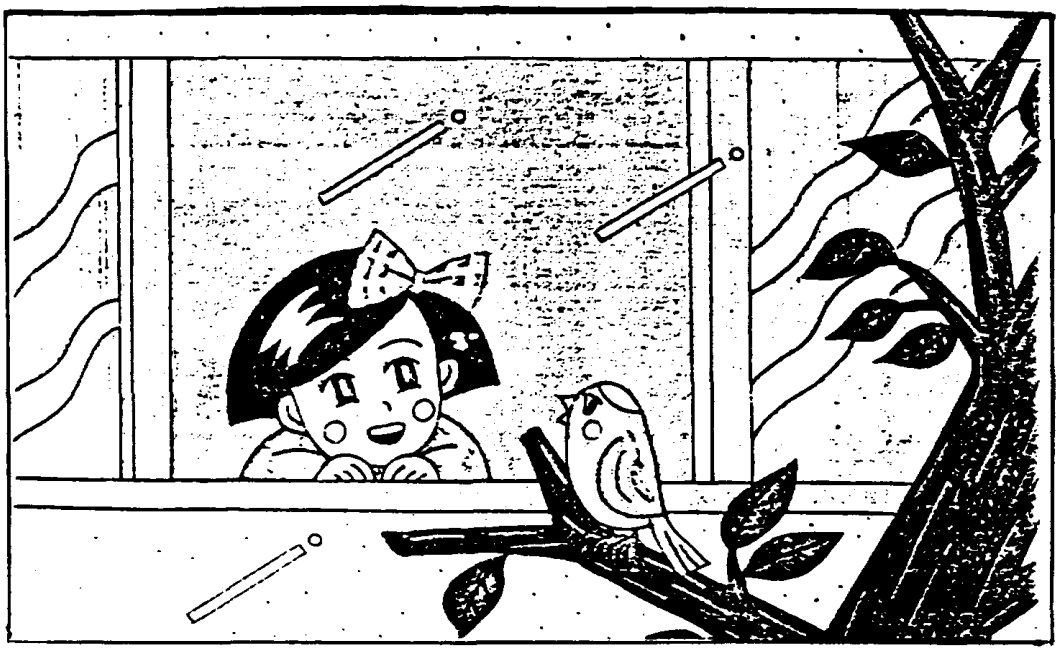

Fig. 5. A Picture by TV-Photo (color)

(d) Listening drill: Learners are able to practice listening to the TV program and obtain necessary knowledge for correct understanding of the content. The system can be stopped any time when the learner pushes "HELP" key. He can listen again to the word or sententce, view them in written form, or refer to the "Dictionary" for its meaning or further examples (Figs. 6 and 7). The use of these functions depend on the learner.

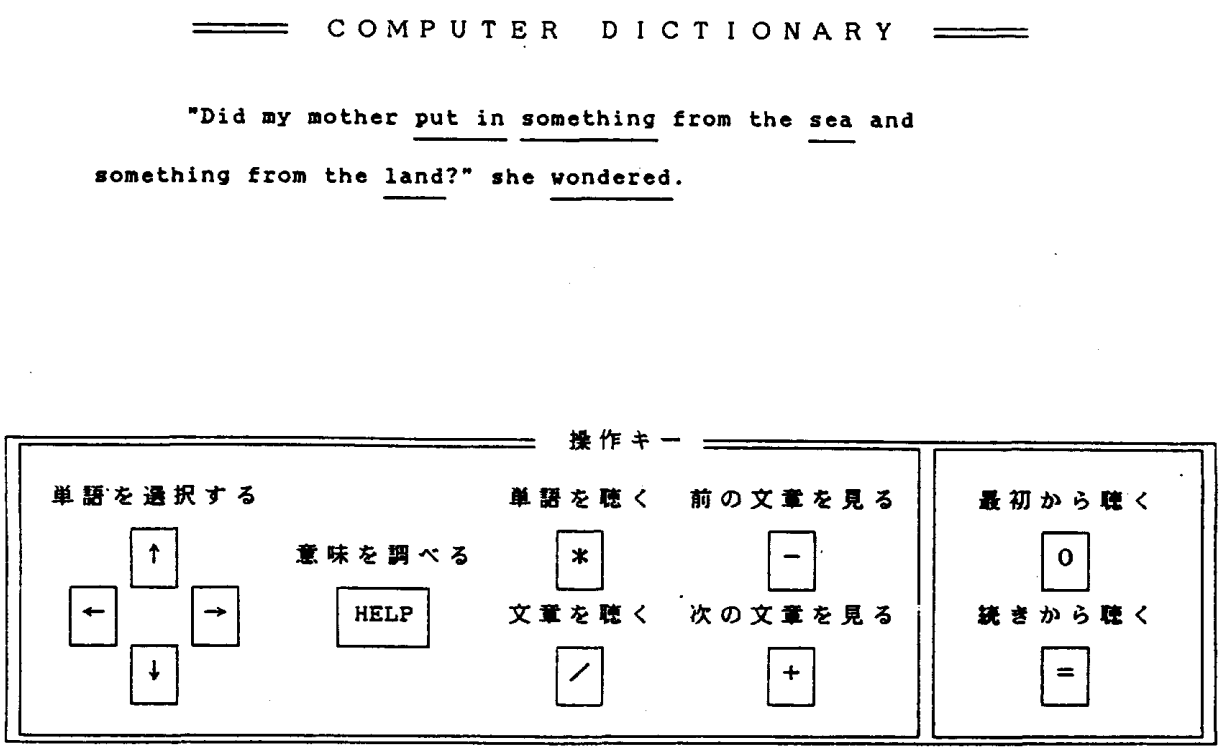

Fig. 6-1. The Display When the Learner Pushes the "HELP" Key

COMPUTER DICTIONARY

"Did my mother put in something from the sea and something from the land?" she wondered.

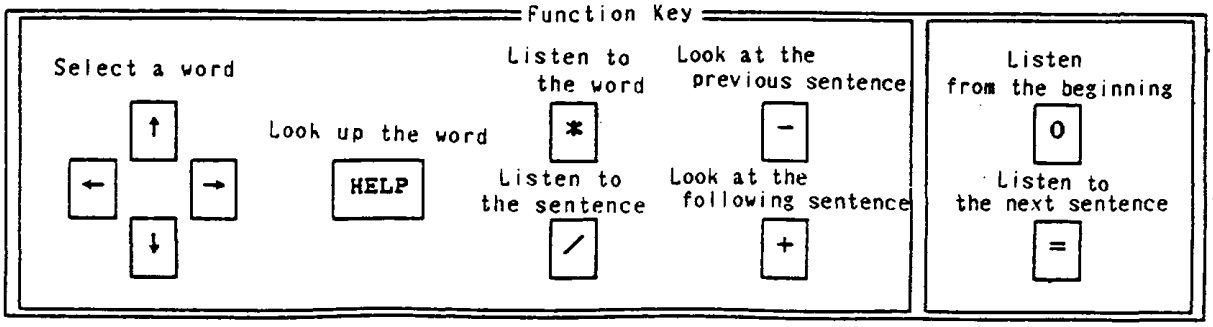

Fig. 6-2. Explanation of Fig. 6-1

COMPUTER DICTIONARY

"Did my mother put in something from the sea and something from the land?" she wondered.

意味と解説： wondered　　wonder の過去形

［動］～かしら、不思議に思う

［名］驚き

例文　I wonder what I had better do.

「どうしたらいいかなぁ。」

↵ を押してください

Fig. 7-1. The Display when the Learner Requests "Dictionary"

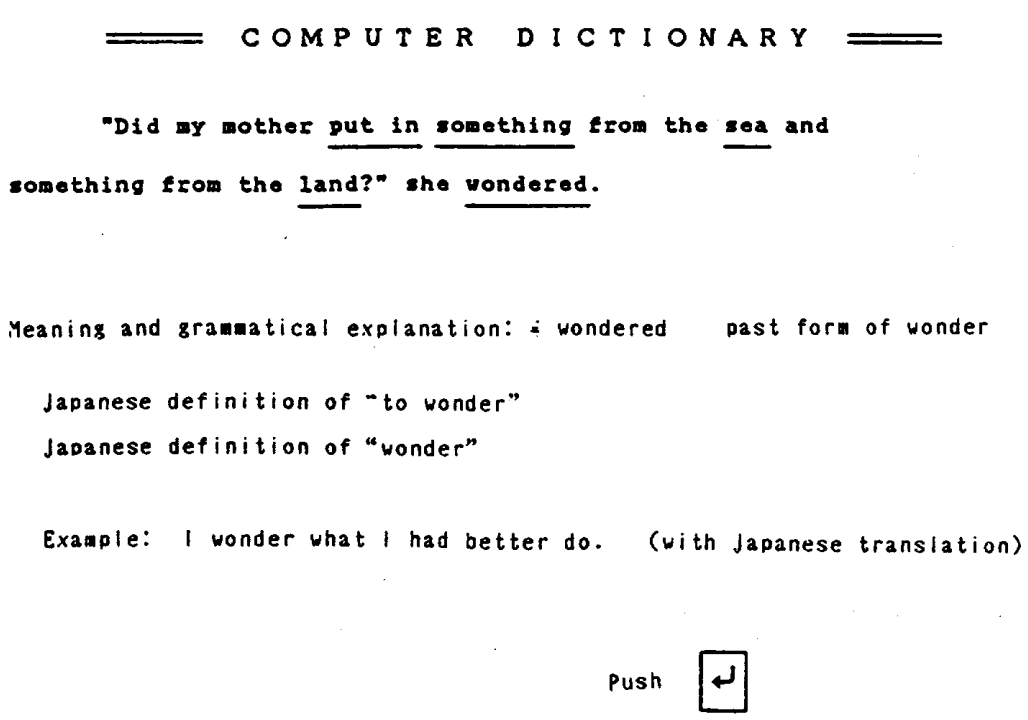

Fig. 7-2. Explanation of Fig. 7-1

(e) Comprehension quiz: This part tests the learners' comprehension of the story with 10 questions. Questions included here are the same as those that are asked on the TV program. If a learner chooses the wrong answer, feedback is given to explain why it is wrong.

(f) Learner's record: The learner's behavior such as his answers, use of "Dictionary", and time spent on each part are recorded and printed out at the end of the whole learning process.

IV. VALIDATION OF THE LEARNING SYSTEM

1. Purpose

A learning experiment with the system was conducted to validate its effects. The effects between learning by viewing the TV program (Control group) and learning with the system (Experimental group) were compared.

2. Subjects

Subjects in this experiment were students in their first year in high school. The control group consisted of 44 students of a private school, and the experimental group consisted of 19 students of a public school in Tokyo.

3. Procedure

The following figure outlines the learning process of each group.

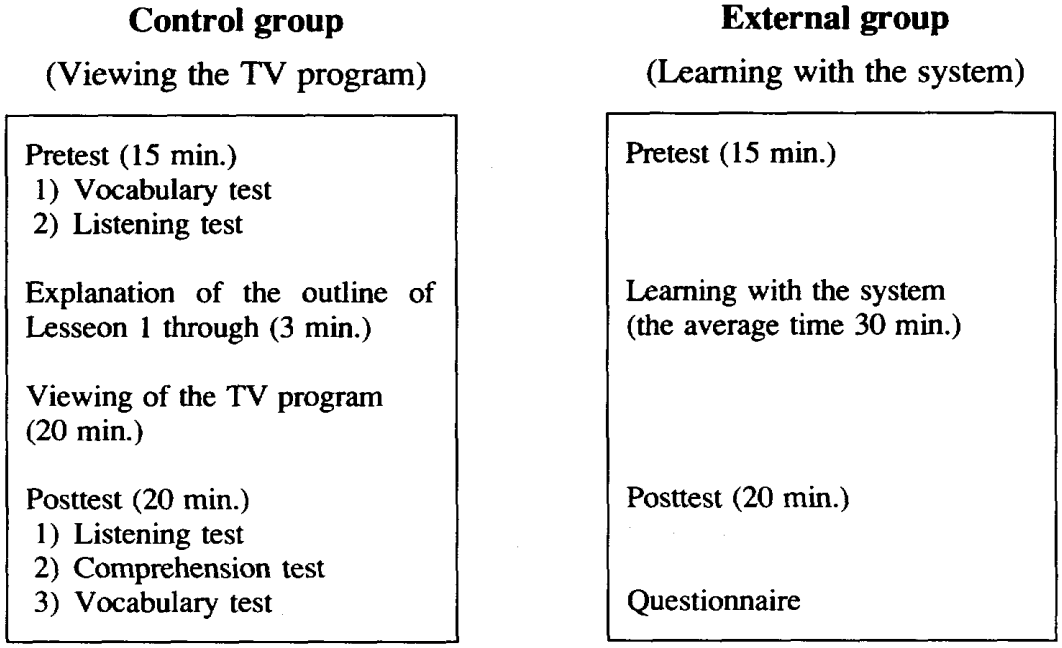

Fig. 8. Procedure of the Expreiment

The following tests, which were improved upon the preliminary study, were prepared to evaluate achievement:

1) Vocabulary test: Fifteen comparatively difficult words were selected from words explained in the TV program, and presented in English sentences. Students were asked to write the meaning of these words. The same test was used for pretest and posttest.
2) Listening test: A listening close test was given for 20 words and expressions which seemed difficult for students to catch. The same test was used for pretest and posttest.

3) Comprehension test: Students were asked to answer with "yes" or "no", to questions on the content of the story.

4. Results

Table 4 shows the means and SDs of listening test scores obtained by the control group (the group viewing the TV program) and the experimental group (that learning with the system). Table 5 shows the results of Vocabulary test, and Table 6, comprehension.

Table 4. Listening Test (20)

	Control (N = 44)		Exp. (N = 19)	
	Mean	SD	Mean	SD
Pretest	13.55	2.78	16.37	2.28
Posttest	17.48	2.23	19.05	1.43

Table 5. Vocabulary Test (15)

	Control (N = 44)		Exp. (N = 19)	
	Mean	SD	Mean	SD
Pretest	9.80	1.66	12.47	1.46
Posttest	12.50	1.56	14.37	0.87

Table 6. Comprehension (10)

	Control (N = 44)		Exp. (N = 19)	
	Mean	SD	Mean	SD
Posttest	8.57	0.91	9.47	0.50

The result of t-test of means shows that posttest scores were significantly higher than pretest scores at the 1% level in both listening and vocabulary tests. No statistical comparison between the two groups could be made, because of the initial differences of their abilities. However, score of posttests and the comprehension tests indicate that the achievement level of the experimental group students was very close to that of mastery learning. The effectiveness indices of listening and vocabulary tests were calculated in both groups, and the results are shown in Table 7.

Table 7. Effectiveness Indices of Both Tests

	Control	Exp.
Listening	64.1	51.6
Vocabulary	81.2	80.9

Wilcoxon Rank Sum test shows that scores of the experimental group were significantly higher. (The significant level is 5% for the listening test and 1% for the vocabulary test). This suggests that learning with the system was more effective than learning by viewing the TV program. However, these results may have been affected by the difference of schools where subjects were drawn from.

5. Learners' Records and Questionnaires

Records of students learning with the system show that time and the use of the learning functions (dictionary, repetition) varied from person to person. In regard to the listening drill, three students listened to the whole story without using functions, yet the other students seemed to have practiced by themselves effectively, according to their own needs. The average time spent for each part of the system was as follows: 4 minutes for vocabulary check and drills, 5 minutes for listening drills, and 4 minutes for story comprehension quizzes.

Questionnaires were given to 19 students who studied with the learning system. On the whole, students had favorable impressions toward learning with the system. This can be inferred from their free comments such as "can get the immediate answer", "can get the explanation", "can learn at my own pace", and "don't feel inhibited to ask questions". Many of them found the advantages of learning by computer useful for their study, compared with traditional class.

V. CONCLUSION

This study was a trial for developing a multi-media learning package in learning the English language. A learning system which effectively combine educational television with CD-ROM and a personal computer was developed, and its effects were validated. In the construction of a system including an educational television program at the center, one important problem to decide on is which medium will be used and how will it be combined. The system has to be built to make maximum use of the strengths, and for compensating for the weaknesses of the central medium. In addition, the system should be in the control of the learner, which was suggested from the fact that learners' records showed their various usage of functions. In this study, a personal computer connected to CD-ROM was used as a medium supplement to an educational television program. The results of the study suggest that the combined use of these two media is effective in the learning of English. CD-ROM has various potentials for the adaptation of learning. Further study about learning behavior, and development of a system more tailored to each learner is in order.

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