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ABSTRACT

Building on the visual orientation of individuals with deafness, and employing such techniques as visualization and directionality, a computer-based method of communicating syntactic knowledge to deaf students was designed. "The Question Game" was designed to model and help students build yes-no questions and WH questions (who, what, when, where). The system utilizes the high resolution graphics capability of the Macintosh computer to achieve visual effects essential to the instructional approach. Written and graphic corrective feedback respond specifically to each error that elementary and junior high-school students make in building English questions, and enable them to correct their misunderstandings. The system provides accompanying pictures to aid comprehension and multiple opportunities to practice and to receive immediate visual feedback. A multiple-choice test, constructed to measure the system's efficiency in teaching 15 students at the 4th/5th or 7th/8th grade levels to recognize correct grammatical structures, showed substantial and rapid improvement, though a test eliciting actual sentence production indicated no significant gains. This final report describes the project objectives, chronology of activities in design and development of materials, and reporting and dissemination activities. Appendixes present a conference paper titled "A Computer Approach to Teaching English Syntax to Deaf Students" by Nancy S. Fogel, and copies of the pre-test and post-test developed for the project. The final report is also accompanied by a teacher's guide to "The Question Game." (17 references) (JDD)

NTRC

New Technology Research Center

Final Report

of the

Technology for English Communication Skills for Deaf Students (TECSD) Project

21 June 1991

Acknowledgement:

Development of the project, *Technology for English Communication Skills for the Deaf (TECSD)*, was supported by a grant to the New Technology Research Center from the Office of Special Education Programs of the U.S. Department of Education. Funding of 100% of the project costs, in the amount of $154,943, was provided under Program #84.180, Project #H180P90014.

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ABSTRACT

The formidable difficulties that deaf students experience in learning English are reflected in the large number of functionally illiterate deaf adults. Instructional methods to date have not effectively developed the ability of the Deaf to read and write English sufficiently. As a result, the majority of deaf adults remain undereducated, underemployed, and limited in their ability to participate fully in our society. Building on the visual orientation of the Deaf, and employing such American Sign Language (ASL) techniques as visualization and directionality, we designed an effective computer-based method of communicating syntactic knowledge to deaf students.

The Question Game, the computerized intervention we developed, utilized the high resolution graphics capability of the Macintosh to achieve the visual effects essential to our instructional approach. Written and graphic corrective feedback responded specifically to each error that elementary and junior high school students made in building English questions, and enabled them to correct their misunderstandings. With accompanying pictures to aid comprehension, and with multiple opportunities to practice and to receive immediate visual feedback, we provided the instructional foundation and methodology to enable deaf students to overcome their difficulties in building WH questions in English.

Reliable tests were constructed to measure the efficiency of the computer-based materials to teach specific English syntax skills. These tests consisted of two parts: Part I, in a multiple choice format, measured the students' recognition of correct grammatical structures, and Part II elicited actual sentence production. Developed in several forms, the tests were administered in a pre- post test evaluation. While probably due to insufficient time on task utilizing the instructional materials, no gains were realized on Part II of the test, Part I of these tests showed substantial and rapid improvement in areas of syntax in which progress with conventional materials in the classroom is at best extremely slow.

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Introduction: A Description of the Research Problem

One of the most discouraging statistics concerning the Deaf population is their low level of functional literacy: average adult reading scores reach only a 4.5 grade level, and only 10 percent of the very best 18-year-old deaf students read above the eighth-grade level. These low levels of reading ability, accompanied by similarly low achievement in writing skills, account in large measure for the underemployment and limited participation by the Deaf in society as a whole.

Deaf children of deaf parents (nine percent of the deaf population) are fluent in the lexicon, syntax and figurative language of their mother tongue, ASL (American Sign Language). Thanks to the pioneering work of William Stokoe (1960) and many others — e.g., Bellugi (1972), Klima and Bellugi (1979), Newport (1977), Siple (1978), Lane and Grosjean (1980) — ASL has been shown to be a fully developed natural language. The remaining 91 percent of the deaf population enter school with various other communication systems like MCE (Manual Coded English) or PSE (Pidgeon Sign English). Most deaf students, even those proficient in ASL, are usually taught as if they had no prior knowledge on which to build their understanding of English. No matter what their previous language experience, the majority of deaf children enter school without the ability to utilize and comprehend English syntax. As a result, almost all deaf students are forced to acquire simultaneously a new language (English), as well as literacy skills in that language: a task never faced by hearing pupils in first language acquisition and usually avoided in second language pedagogy.

An idea generally accepted by educational researchers and practitioners is that teaching new concepts is facilitated by relying on existing knowledge and the abilities of students. In the case of teaching English syntax to the deaf, this idea has been particularly emphasized by recent discussion and research which underline the parallels between teaching English to the deaf and the teaching of English as a Second Language (ESL), especially in the context of Bilingual Education (Strong, 1987; Cummins, 1984; Fischgrund, 1982). Thus, techniques developed in ESL, especially those which utilize visual rather than primarily auditory approaches, seem particularly appropriate in devising material for deaf children.

In the utilization of visually based ESL techniques in presenting English syntax, we have been intrigued by the possibilities inherent in Computer-Assisted Instruction (CAI) and the experience garnered in the rapidly developing field of Computer-Assisted Language Learning (CALL). We have thus developed, and continue to further improve, experimental materials with state-of-the-art software that can be used to teach English syntax to deaf students. Microcomputer-based language programs can offer ways to build upon the prior language-related, visual knowledge that the Deaf acquire in learning sign language.

Where most English instruction relies on the linear sequencing of the language, CAI can add the ASL dimensions of position and motion in space to enhance English language learning; as

a result, educational software can offer deaf students more rewarding opportunities for interactive language experience than they usually encounter. Utilizing visualization and simultaneity of expression, which the Deaf use so effectively in ASL communication, CAI can employ graphics, windows, and reverse video to highlight and emphasize instructional points and to provide corrective feedback. Through CAI designed specifically for the Deaf, students can be motivated to interact with an instructional environment in which syntax, vocabulary, and figurative language are linguistically controlled and incrementally graduated in difficulty. English language acquisition and usage can proceed at the learner's pace, but more rapidly than previously experienced by deaf students.

As stated in Toward Equality: Education of the Deaf (the report of the Commission established by Public Law 99-371 in August of 1986 to study, evaluate, and make recommendations on the quality of education of the Deaf), facilitating English language acquisition, as well as supporting the technological application of new research in the linguistic processing of deaf children, should be top priorities in federally funded research (Commission, 1988). Recognizing the needs of deaf children and young adults, the Office of Special Education Programs (OSEP) granted eighteen month support to the New Technology Research Center to investigate the efficacy of using highly visually-oriented techniques in CAI designed to teach English syntax to deaf students.

Project Objectives

To determine the effectiveness of highly visually-oriented CAI for teaching difficult syntax skills to Deaf students, we established four project objectives:

1. To design and develop maximally effective CAI materials through consultation with members of the advisory panel, and formative evaluation by deaf students and their teachers at regional schools
2. To effectively manage the development of code, graphics, and documentation materials
3. To establish a relationship with a publisher to facilitate marketing
4. To disseminate the generalizable aspects of the design approach and the report-worthy findings from field testing to the educational technology and deaf research communities

To elucidate upon the above objectives, the TECSD project was the second phase of a three phase research and development effort. The first phase, the AVM project (Fogel, 1988; Fogel, 1989), evaluated the effectiveness of using icons and other visual devices to communicate syntactic information to Deaf high school students who had not acquired the necessary reading comprehension skills to rely solely on textual clues and information. Building upon the visual

effects and feedback which had proved most successful in teaching yes-no questions in phase one, we expanded the content to more difficult structures, wh-questions, in phase two (TECSD). At the same time we turned our attention toward a different student population — elementary and junior high students — to ascertain whether even more difficult treatment materials would be effective in a "teaching" mode with a younger population, rather than the "remediation" mode with older students in phase one. The third phase (TECSD-NET), which would have investigated the unexplored territory of using networks and animation to teach English structures most difficult for deaf students, has not yet been funded.

Methodological Approach

The research plan for the TECSD Project was an iterative and multi-phase process which included: consultation with experts; design and development of materials; testing, analysis, and revision; and dissemination. The soundness of this process was apparent as the project director, Nancy S. Fogel, re-evaluated the plan when she joined NTRC to conduct the TECSD Project. In updating a recent literature search (Fogel, 1989) with the results of recent studies and the technological advances which occured between proposal submission and funding, the needs for several revisions of the specific content of the proposed curriculum and of the program architecture were indicated. In place of MacApp, the prototyping environment we had used, we strengthened the TECSD program by using the *Think C* environment and the "*C* " language. This change provided the engineering staff with greater control of the graphics' routines, which are critical to the effectiveness of these materials, and also resulted in a more compact version of the program — important to end-users and therefore publishers. In addition, we investigated linguistically controlled texts and recent revisions to the curricula of several programs for deaf students to update the proposed content of the software to be developed. We also took into consideration the results of previous studies of deaf students' language acquisition (Fogel, 1990) and CALL (Computer Assisted Language Learning) to refine the Yes-No section.

When reading the description of the instructional materials, we ask the reader to keep in mind that many of the very techniques that make the computer so useful in the presentation of materials for the deaf cannot, of course, be captured in a printed report. The difficulty of presenting *The Question Game* in a written report is as complex a problem as capturing the essence of ASL in linear English text. Therefore, we encourage readers of this report to review the accompanying disks of *The Question Game* if they wish to familiarize themselves with the techniques and materials that were developed.

1. Design

Most English instruction focuses on the linear sequencing of the language; it does not demonstrate linguistic relationships by movement in space. However, computer-assisted instruction (CAI) can add the ASL dimensions of position and motion in space to enhance English language learning; as a result, educational software can offer hearing-impaired students more rewarding opportunities for interactive language experience than they usually encounter. Utilizing visualization,[1] directionality,[2] and simultaneity of expression,[3] which the Deaf use so effectively in ASL communication, CAI can employ graphics, windows, and reverse video to highlight and emphasize instructional points and corrective feedback. Even if the learners are not competent in sign language, we can assume a predisposition to rely on a visual modality in their communication.

The computer's special graphic capability can present concepts linked to the visual-gestural knowledge base of the Deaf; incorporating graphics as a visualization technique clarifies meaning and enhances comprehension so that learners are not required to rely primarily on textual material. The computer's capacity for visualization and simultaneity of expression, as well as for interactive instruction and immediate feedback, offer a way to build upon the prior language-related, visual knowledge that the Deaf acquire in learning sign language. Through CAI designed specifically for the hearing-impaired, students can be motivated to interact with an instructional environment in which the syntax, vocabulary, and figurative language are linguistically controlled and incrementally graduated in difficulty. English language acquisition and usage can proceed at the learner's own pace, but more rapidly than previously experienced by deaf students.

Current research validates CAI techniques which provide students with semantically meaningful language environments and with opportunities to initiate *real* communication (Rivers, 1987; Hubbard, 1985; Littleweood, 1981). We strengthened our original instructional design by providing opportunities for students to ask *real* questions — ones for which they did not know the answers; to the students' delight and surprise, the computer supplied the answers (both visually and textually) to the wh-questions that they built.

2. Development of Treatment Materials

In each phase of the development of the *Question Game*, we utilized an iterative process. Guided by the results of our previous research and the new ideas regarding linguistic processing and CALL that our updated literature review revealed, we consulted linguists on our Advisory

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[1] Visualization — focusing on sight (e.g., using computer graphics and video effects) as the primary mode of communication to convey syntactic information.

[2] Directionality — modulations (e.g., of verbs) to indicate such grammatical relationships as subjects, objects, and locations.

[3] Simultaneity of expression — the co-occurence of grammatical or lexical information (e.g., aspects of time, as regularity, duration, repetition, tense).

Board, developed the curriculum and instructional screens, presented the plans to teachers at the participating sites, incorporated their feedback into our design, tested the revised materials, and repeated the process with the next part of the *Question Game*.

Sections

The Question *Game* is divided into three sections: Macintosh Instructions, the Yes-No *Game* and the *WH-Game*. The Macintosh Instructions are composed of a series of interactive screens to enable the novice to use the computer and the *Question Game* with facility. These instructions, obligatory for first-time users, show students how to click and move the mouse, and how to click the GO, ERASE, and QUIT buttons to navigate through the *Question Game*. Once the program has recorded the unique name of the student, the Mac Instructions are optional.

The *Yes-No Game* is composed of seven parts, which provide multiple opportunities to build yes-no questions with single and plural subjects, as well as present and past tense verbs. Each part contains three to ten structures of increasing length and documented difficulty for the Deaf (Quigley, 1978).

- Part 1: BE as a main verb
- Part 2: BE as an auxiliary with regular verbs
- Part 3: Regular verbs with the DOES auxiliary
- Part 4: Regular verbs with the DO auxiliary
- Review 1: Regular verbs with the auxiliaries, DOES and DO
- Part 5: Regular verbs with the DID auxiliary
- Review 2: Regular verbs with the auxiliaries, DOES, DO, and DID

The *WH-Game* is composed of four sections: WHO, WHEN, WHERE, and WHAT. Each section has two to three parts with opportunities to build wh-questions with single and plural subjects, present and past tense verbs, and regular and irregular verbs. In each part, the questions to be built are increased in length and difficulty as the student progresses.

- WHO
  - Part 1: BE as a main verb
  - Part 2: BE as an auxiliary with regular and irregular verbs
  - Part 3: Regular and irregular verbs with the auxiliaries, DOES, DO, and DID
- WHEN[1]
  - Part 1: BE as a main verb
  - Part 2: BE as a main verb with longer structures

[1] Because of time constraints, DOES, DO, and DID were not developed with the interrogative WHEN.

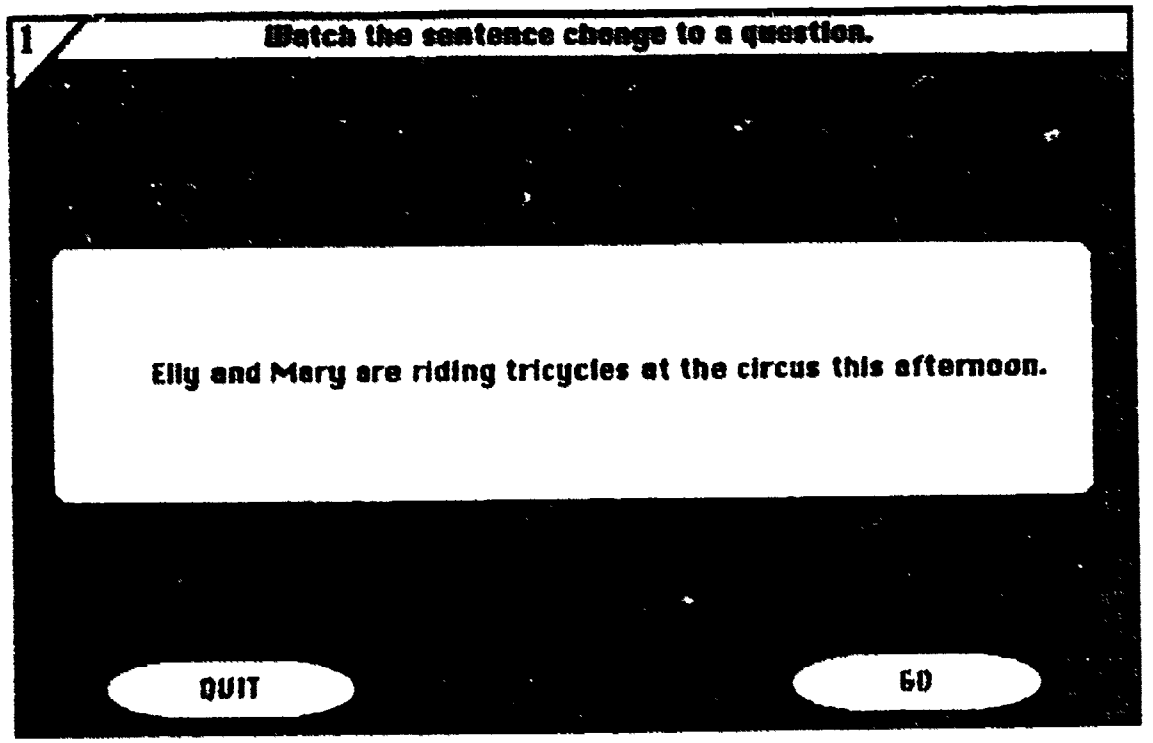
- WHERE:
  - Part 1: BE as a main verb and as an auxiliary with regular and irregular verbs
  - Part 2: Regular and irregular verbs with the auxiliaries, DOES, DO, and DID
- WHAT:
  - Part 1: BE as a main verb
  - Part 2: BE as a main verb with longer structures
  - Part 3: Regular and irregular verbs with the auxiliaries, DOES, DO, and DID

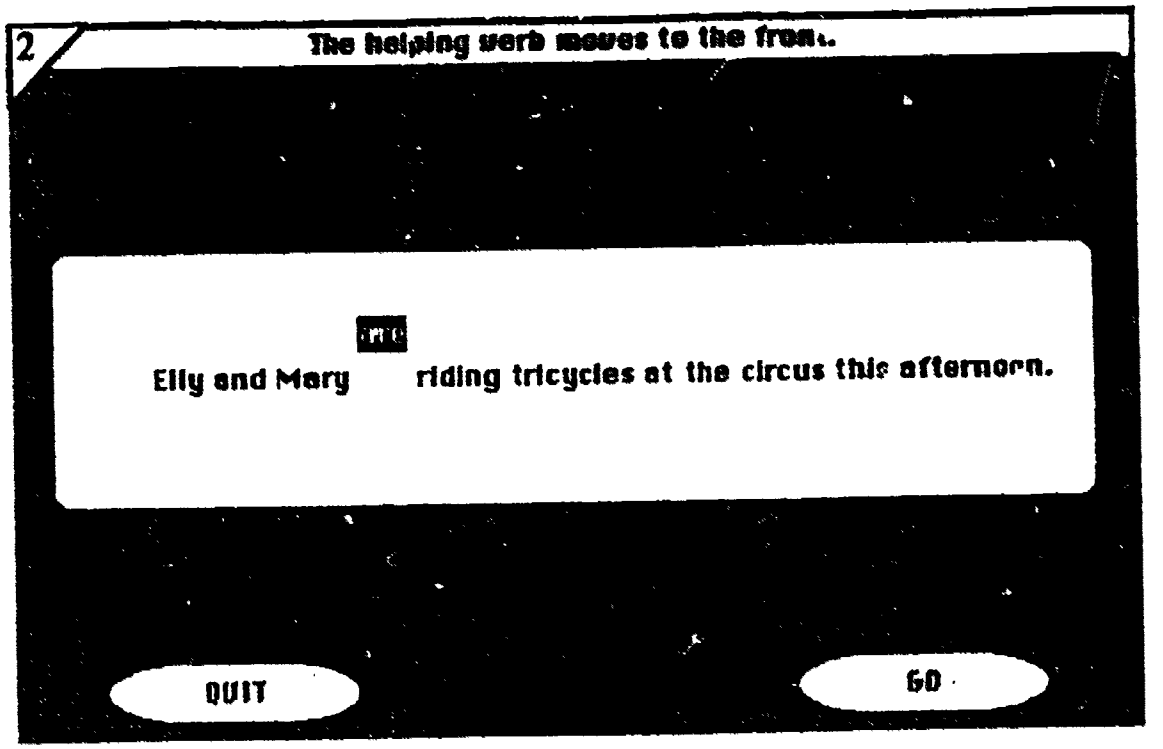
Throughout the *Question Game*, title screens introduce each section; congratulation screens conclude each section successfully completed and return the student to the main menu — to exit the program or to select another section of the *Question Game*. Each part of the *Yes-No Game* and the *Wh-Question Game* begins with a modeling of how to build the particular questions in that part.

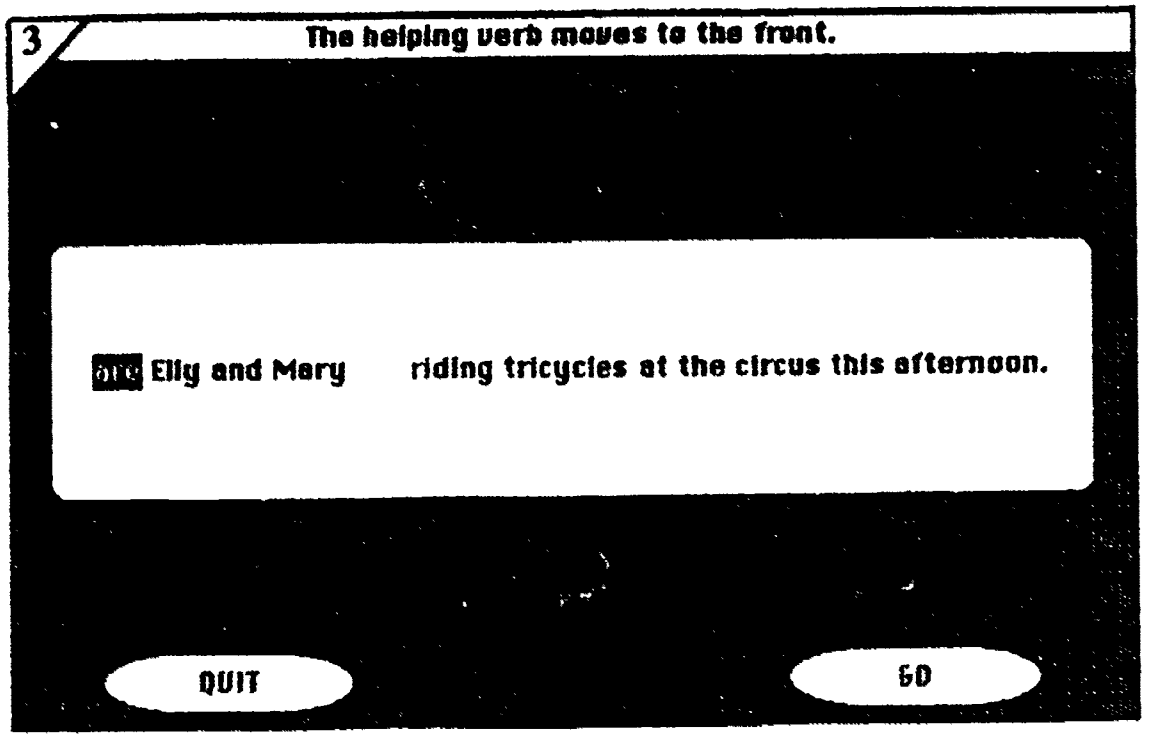
Modeling and Building Yes-No questions

To guide learners through visual syntactic models, animated graphics picturing the transformation of sentences to questions precede multiple practice opportunities for each syntactic structure taught. By visually depicting the transformation of a sentence to a question, as shown in Figure 1, the students are provided with an alternative to relying exclusively on printed text for reading comprehension. After a sentence appears in the "modeling/transformation" section of Parts 1 and 2 of *The Yes-No Game*, the BE verb in the sentence (e.g., Elly and Mary are riding tricycles at the circus.) is lifted above the other words and travels to the beginning of the sentence, where it drops into place. The empty space which held the auxiliary verb closes, the first letter of the fronted auxiliary verb is capitalized, and the period is replaced with a question mark at the end of the question (Are Elly and Mary riding tricycles at the circus?).

The transformation of a more complex yes-no structure is depicted in Figures 2a and 2b. After a declarative sentence is displayed (Fido plays chess in the kitchen every Monday.), the "s" in "plays" duplicates itself in the line above; "doe" appears and meets the "s" to form "does." Next, "play" in the sentence duplicates itself in the line above; "does play" in the line above flashes alternately with "plays" in the sentence to visually state that both expressions are the same. Slowly, "does play" moves down into the sentence to replace "plays," which moves down and dissolves. In the new sentence (Fido does play chess in the kitchen every Monday), "does" flashes and moves to the line above; "does" travels left to the beginning of the sentence, where it drops into place. The empty space which held the auxiliary verb closes, the "d" in "does" is capitalized, and a question mark replaces a period at the end of the sentence (Does Fido play chess in the kitchen every Monday?). Such visual representations of language structures and







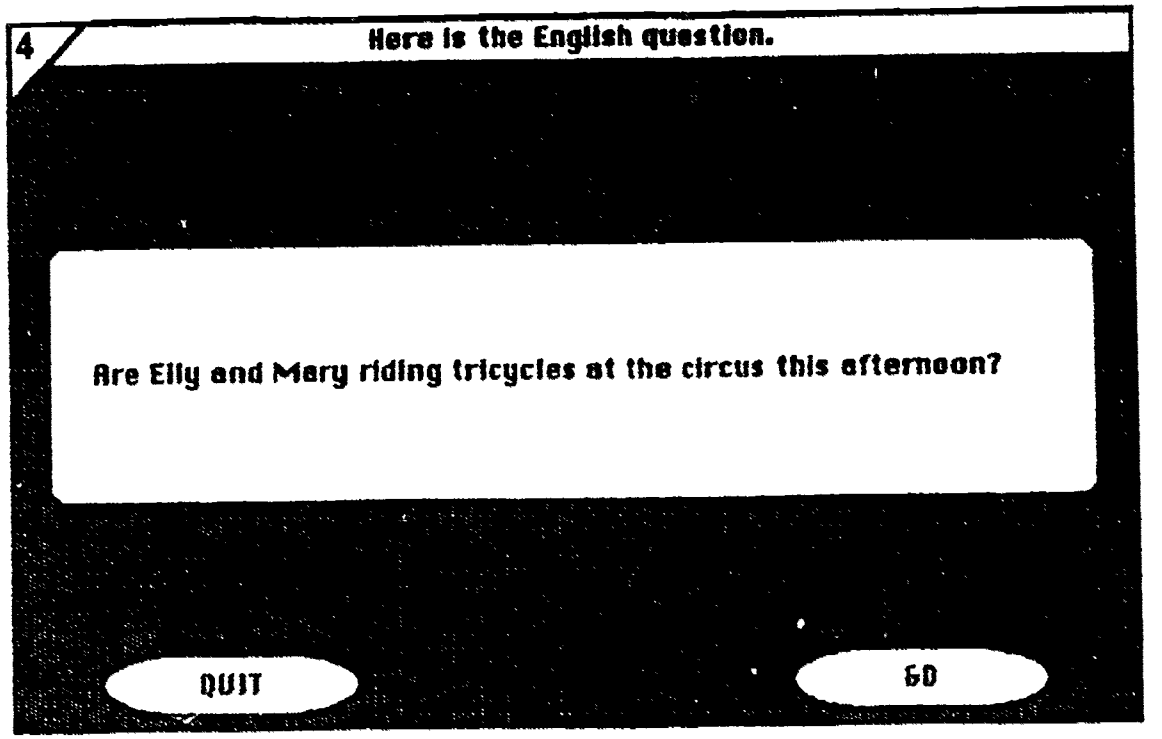
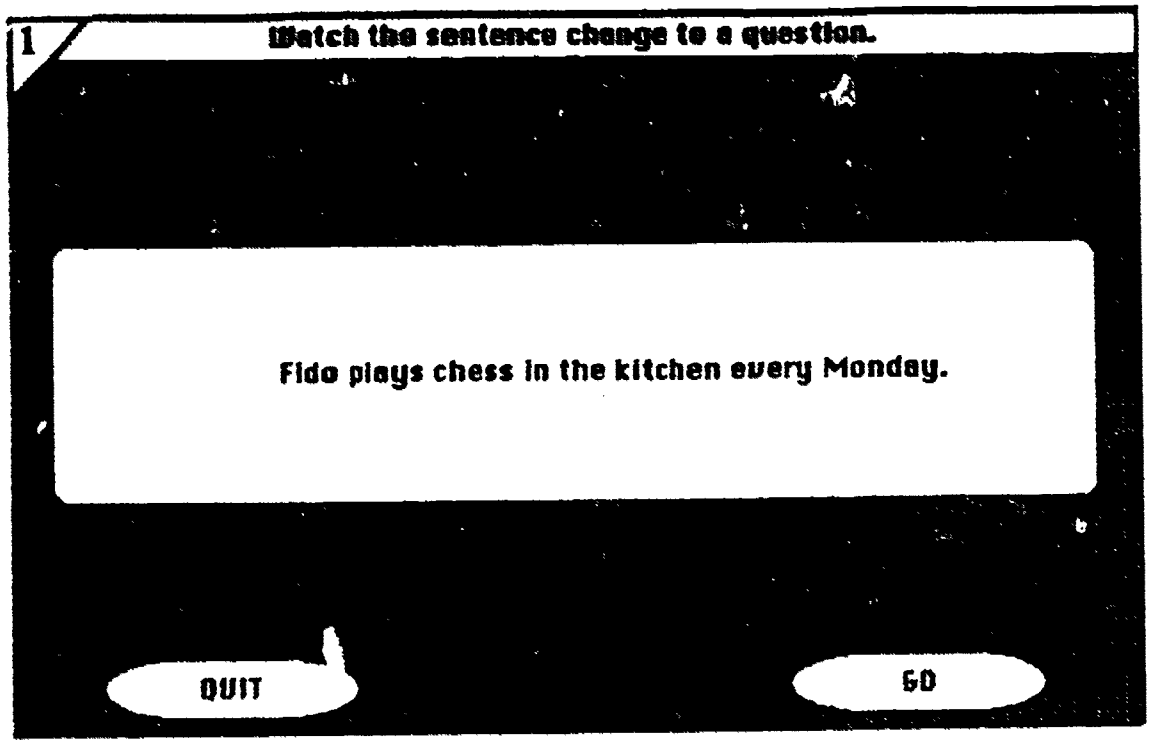
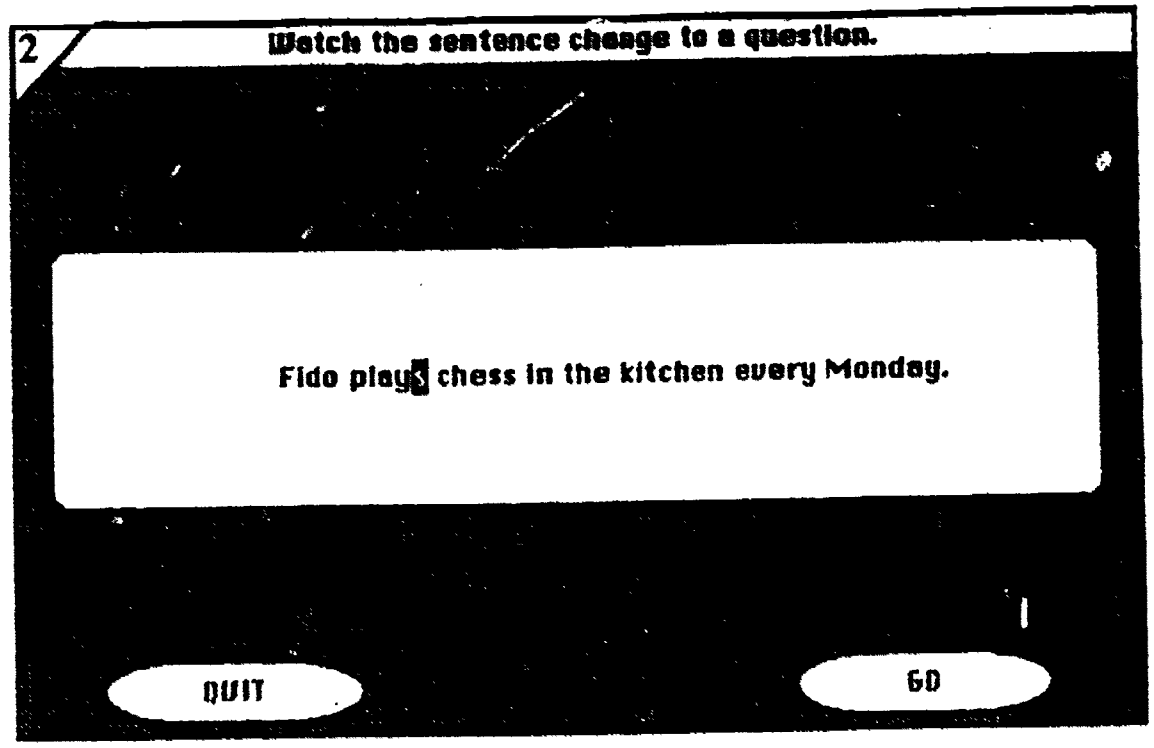
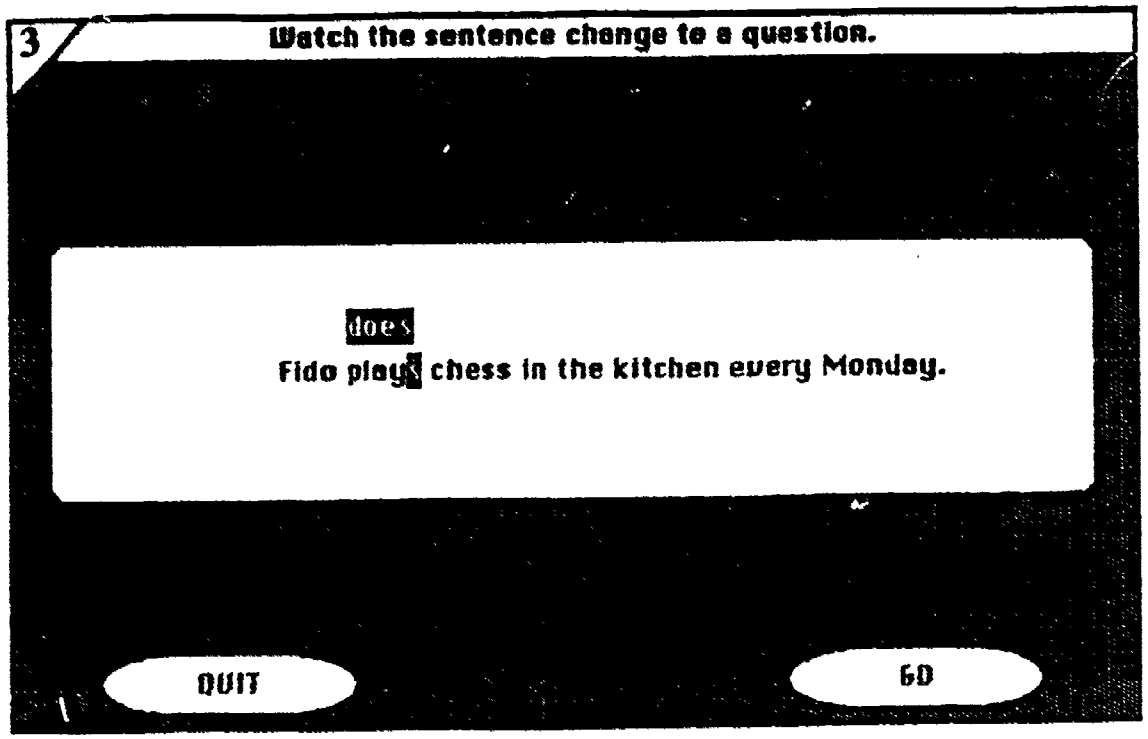


Figure 1. Transformation of a Sentence (with the BE verb) to a Yes-No Question







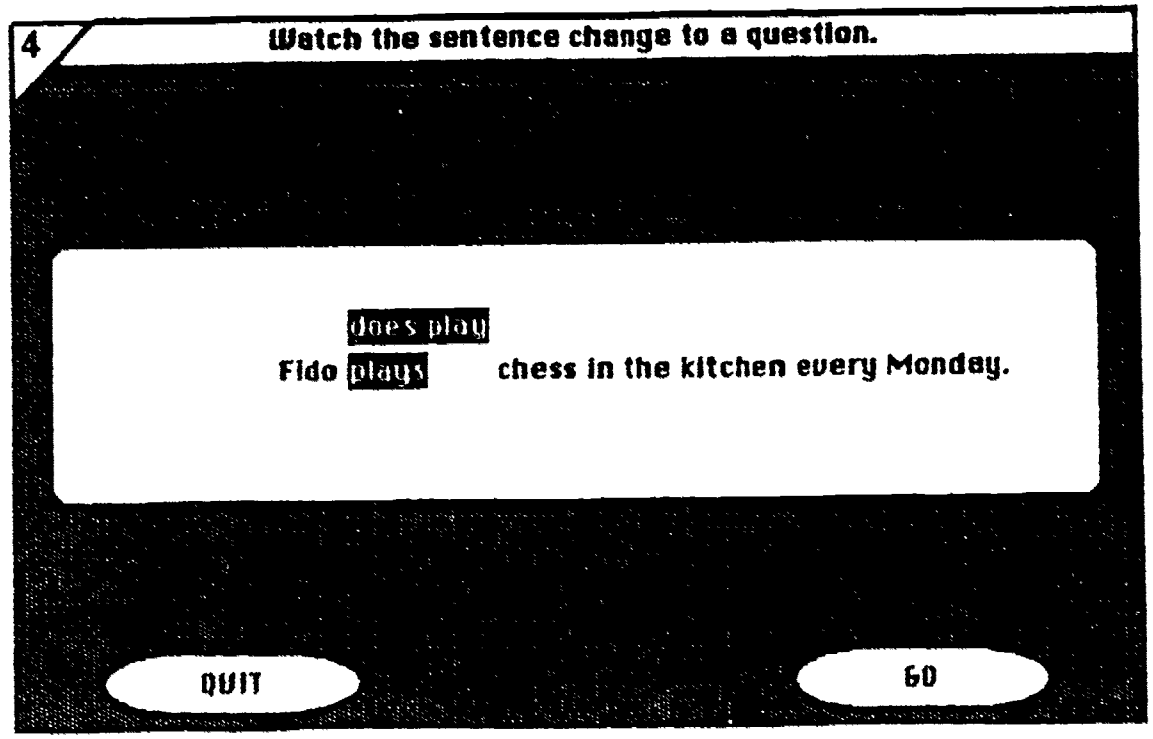
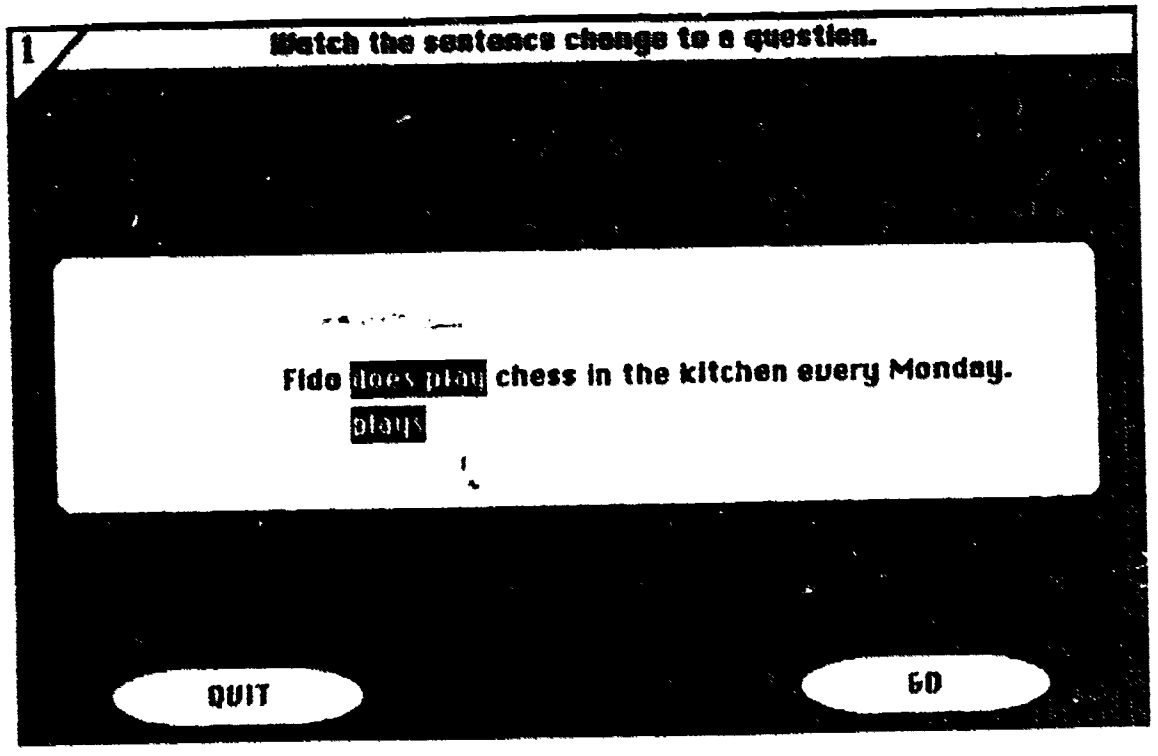
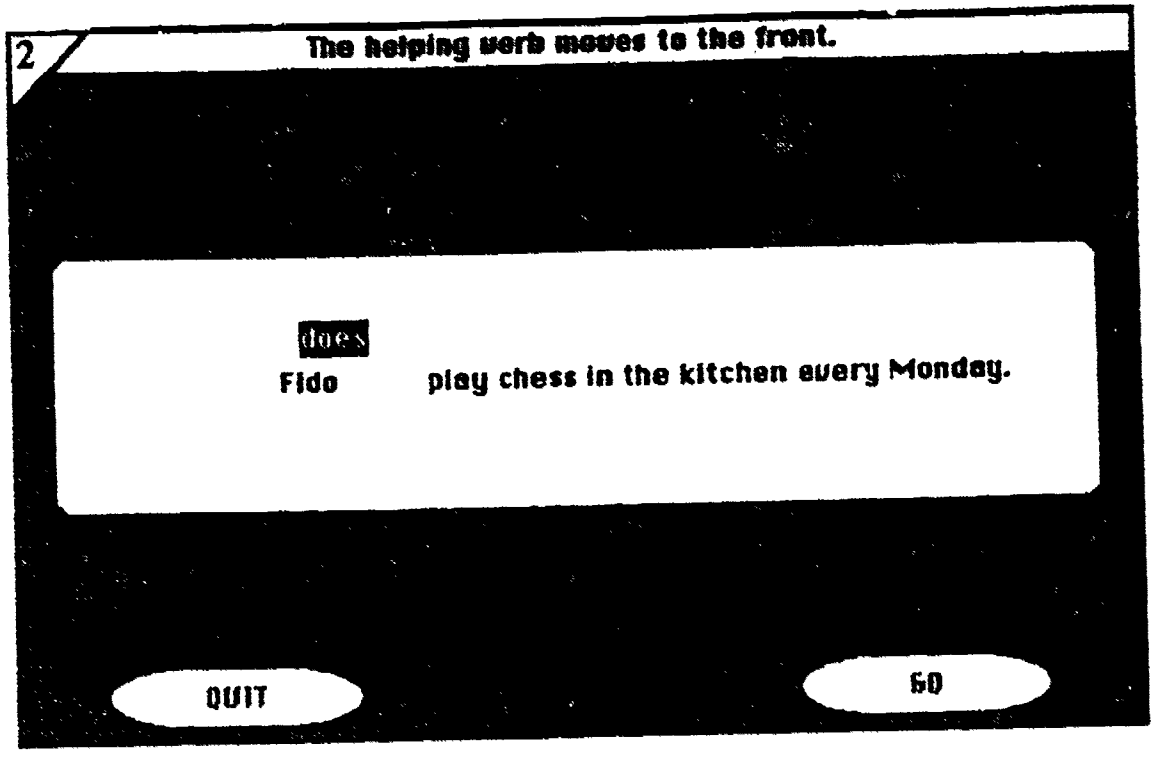
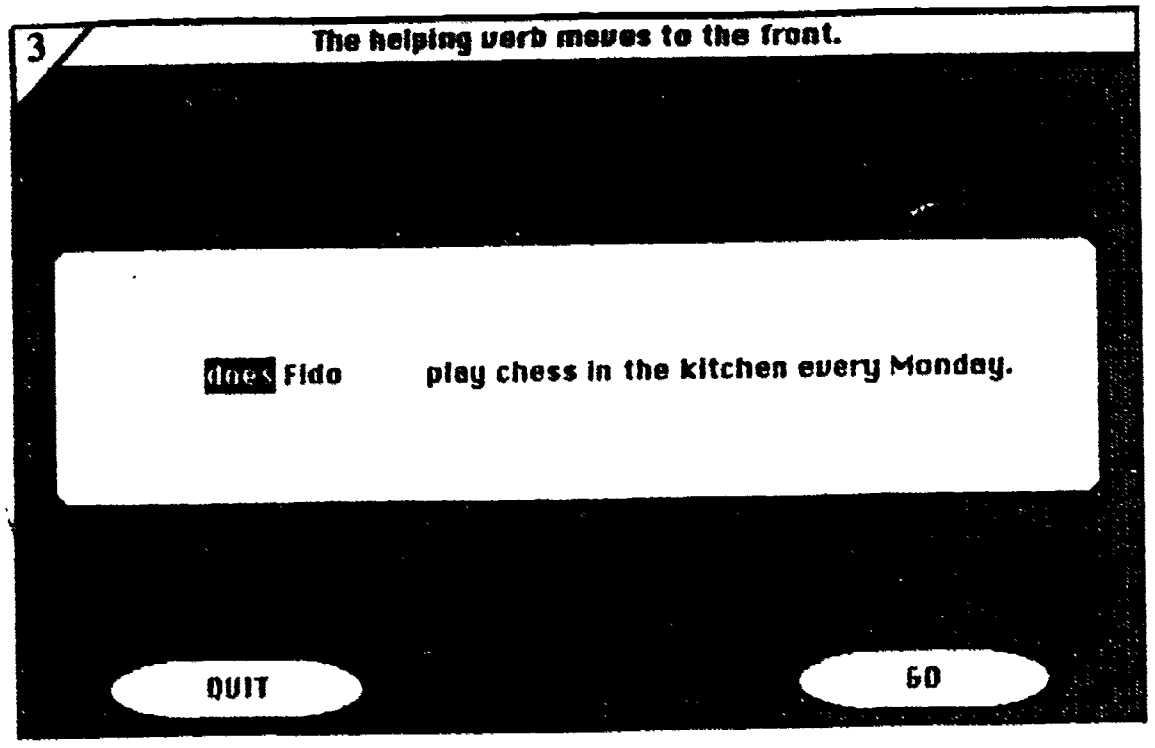


Figure 2a. Transformation of a Sentence to a Yes-No Question with the DOES auxiliary







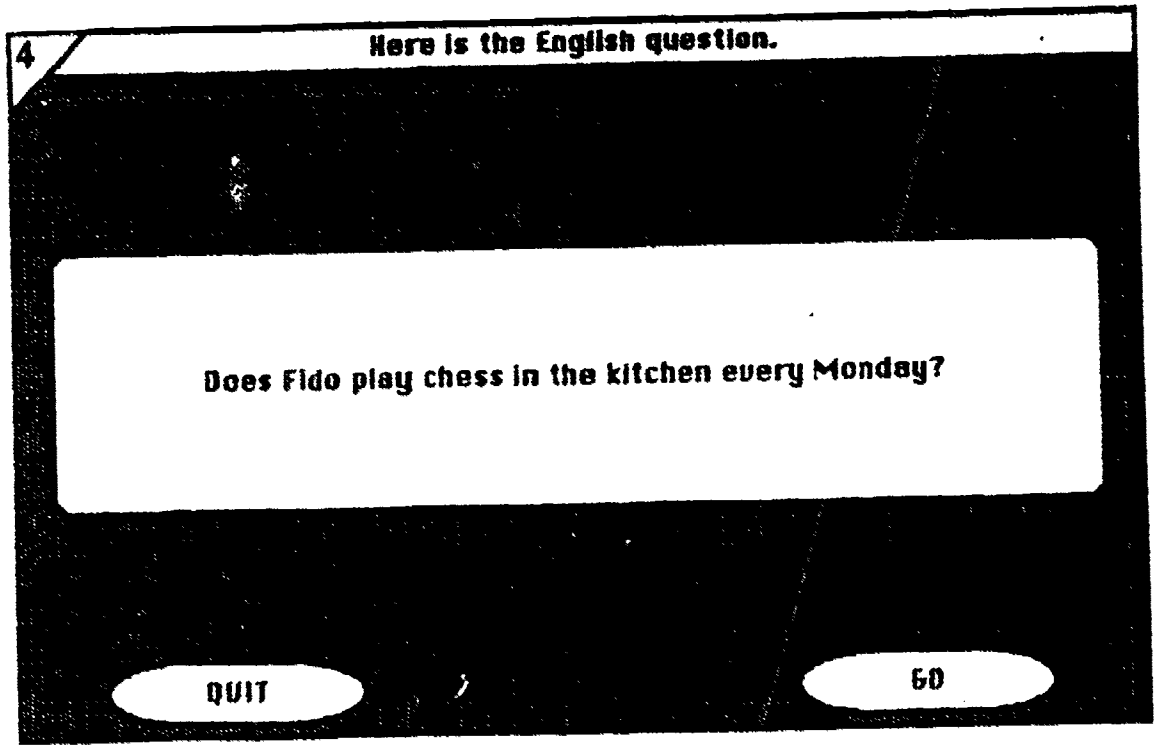


Figure 2b. Transformation of a Sentence to a Yes-No Question with the DOES auxiliary

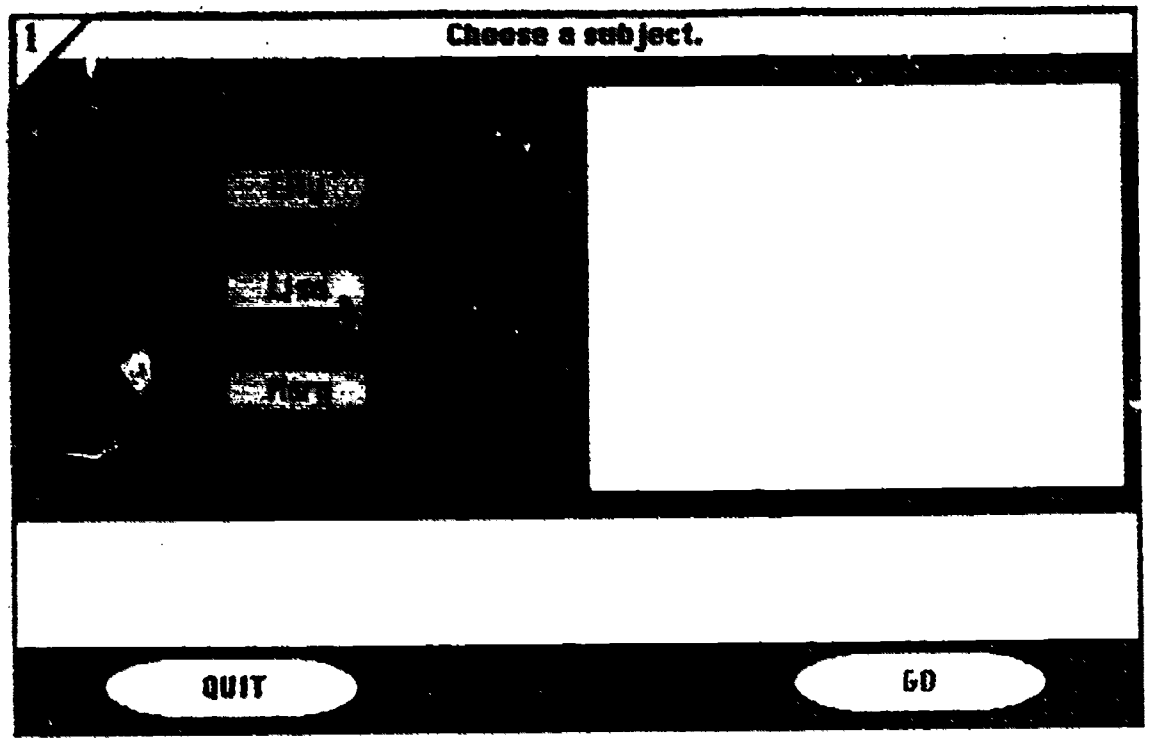
transformations are an integral part of both the instructional modeling and the immediate, corrective feedback in the *Question Game*.

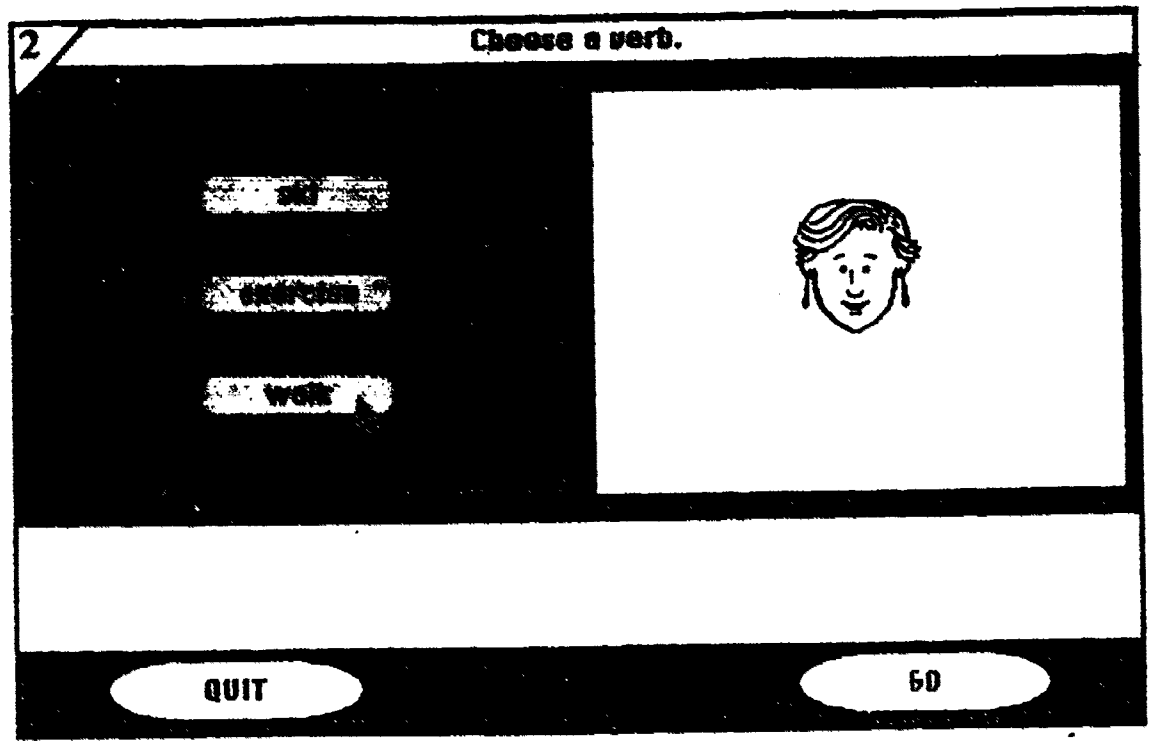
To capitalize on ASL's visualization and simultaneity of expression, computer graphics and animation have been incorporated to enhance comprehension, clarify meaning, and maximize the transfer of relevant knowledge. In addition, to engage and motivate the learners, we involved them as active participants in their instruction. First, students are provided with multiple opportunities to build their own — often humorous — sentences, which are automatically illustrated by the program. As shown in Figure 3, "Creating a Picture-Sentence," a student chooses the subject "Lisa" from among six possibilities (which are randomly selected from a file of 20 possible subjects), and the head of Lisa appears in the picture box above the word choices. Next, if the student chooses the verb "wa'k" from among six randomly displayed verbs, the picture changes to display Lisa walking. Similarly, direct objects and adverbials of time and place are selected; as each word is picked, a visual counterpart is added to the picture to represent the sentence as it is built by the student.

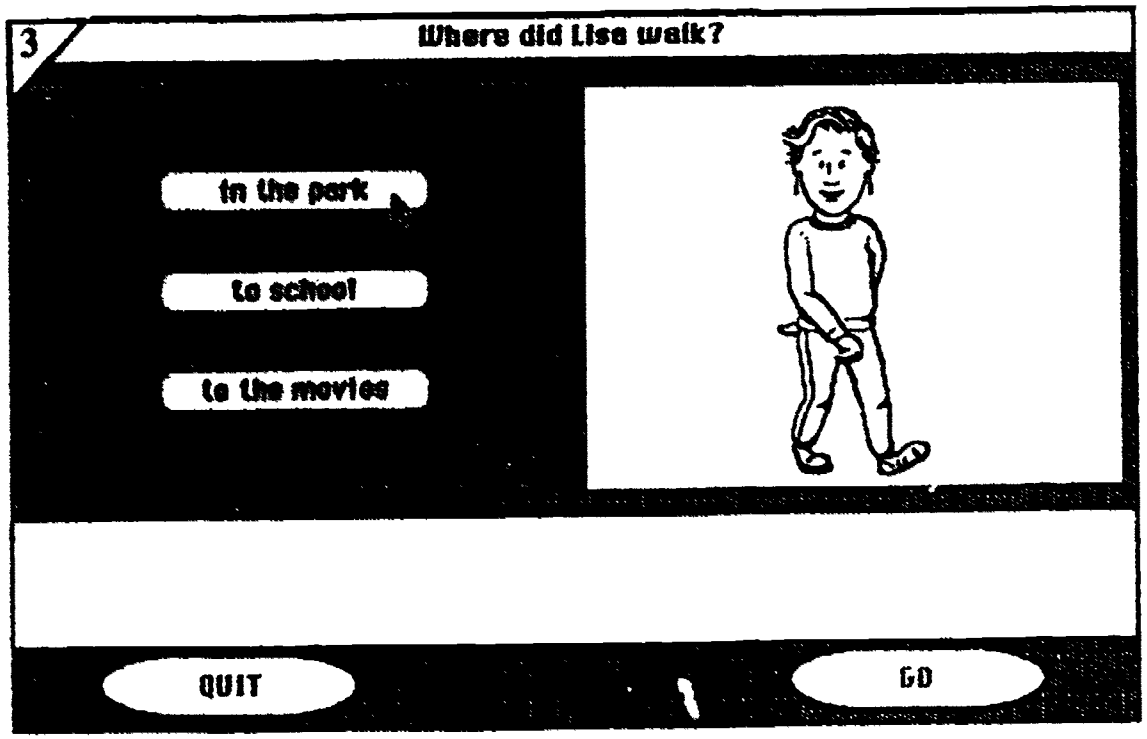
After the sentence is completed and its picture displayed, the "Building a Question" screen invites the student to create an appropriate yes-no question for the picture; Figure 3 displays a sample screen containing a picture and a matrix of possible words and phrases from which students build their own questions. Unlike most CAI, *The Yes-No Game* does not limit learners to making simple choices among a set of "right answers"; prior analysis of error patterns for the yes-no syntactic patterns are used to ensure that words and phrases were present that would allow learners to make common mistakes. For example, for a picture of Leo driving a truck every day, the randomly presented items could include a period, a question mark, and the following words: Leo, do, does, did, drive, drives, drove, a truck, and every day.

Modeling and Building WH-questions

The modeling and question building in the WH-Game provided the students with the opportunity to ask *real* questions — for which the accompanying pictures gave vocabulary clues but *not* the answers. Because the students learned how to transform a sentence to a yes-no question in the *Yes-No Game*, and because several of the wh-question structures required an additional transformation which could be visually confusing, in the *WH-Game* we modeled the building of the wh-question — part by part. As shown in Figures 4a and 4b, first the student clicks a wh-word in the word box matrix; depending upon the structure, the student selects an auxiliary verb, followed by a main verb, a direct object, an adverbial of place, an adverbial of time, and finally a question mark. Only when the question is built correctly (as in Figures 5 and 6), is the answer revealed visually and textually: in the *WHO Game*, the masked character is revealed and the written answer/sentence displayed; in the *WHEN Game*, the correct month of the holiday or special day is flashed on a calendar and in the word box; in the *WHERE Game*, one of the answers







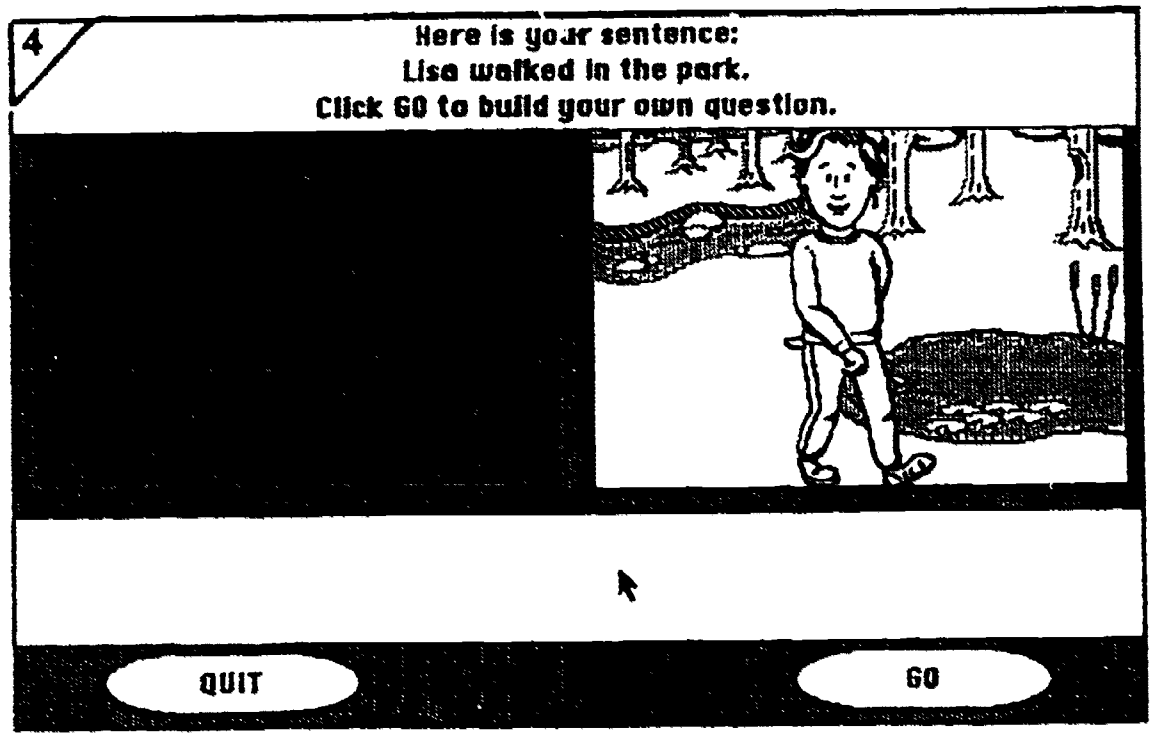
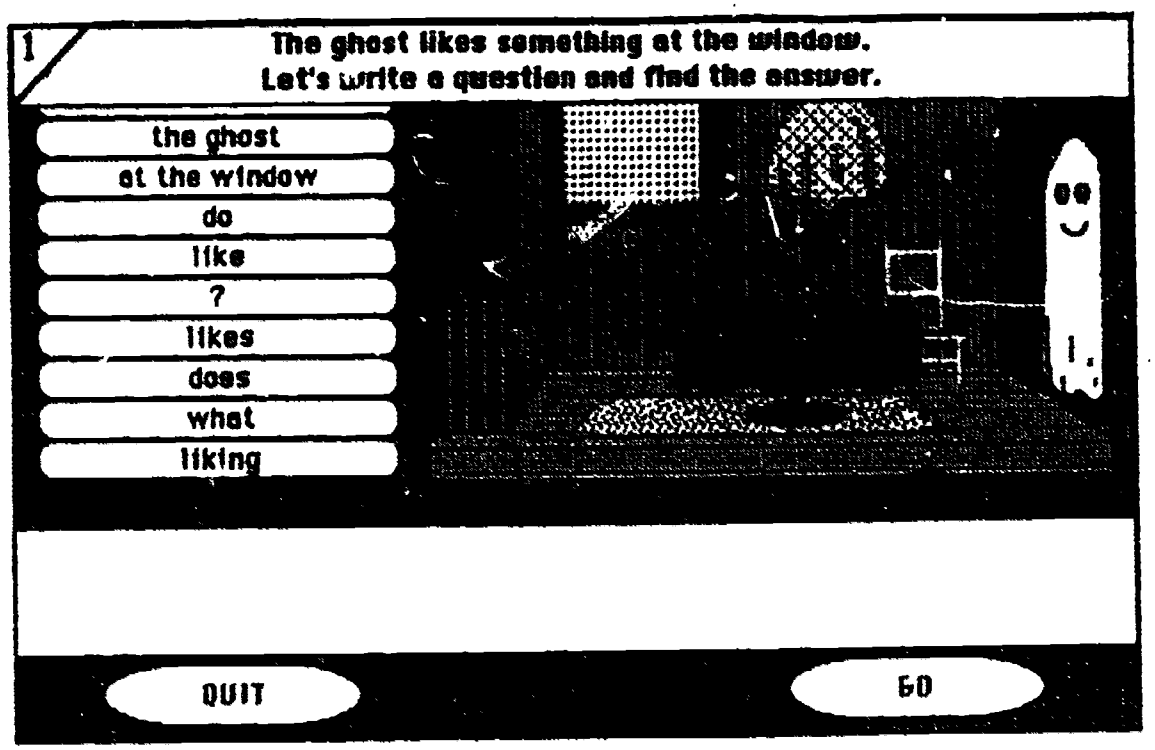
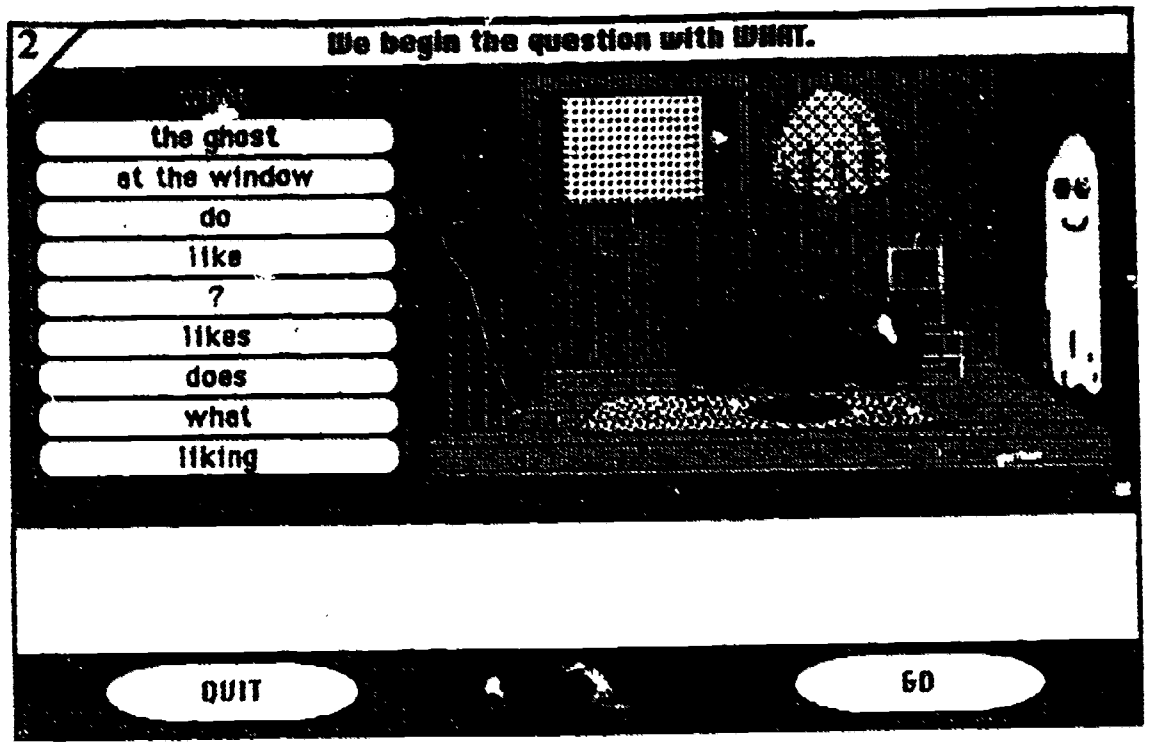
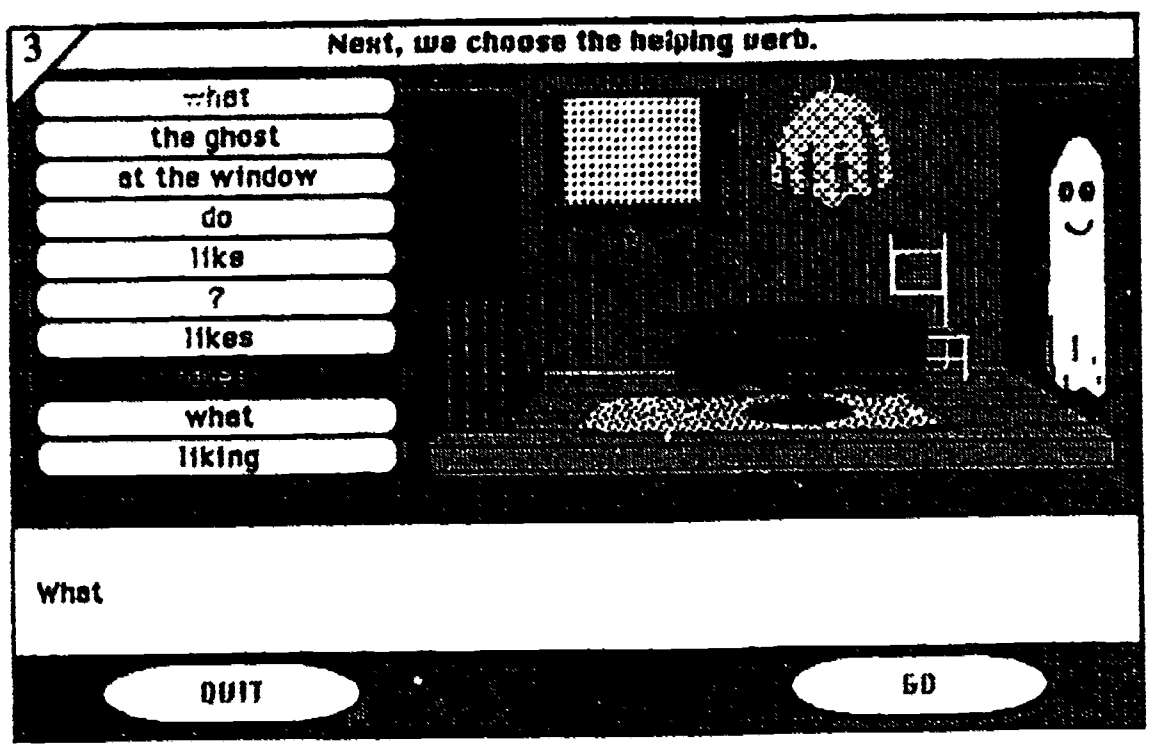


Figure 3. Creating a Picture-Sentence







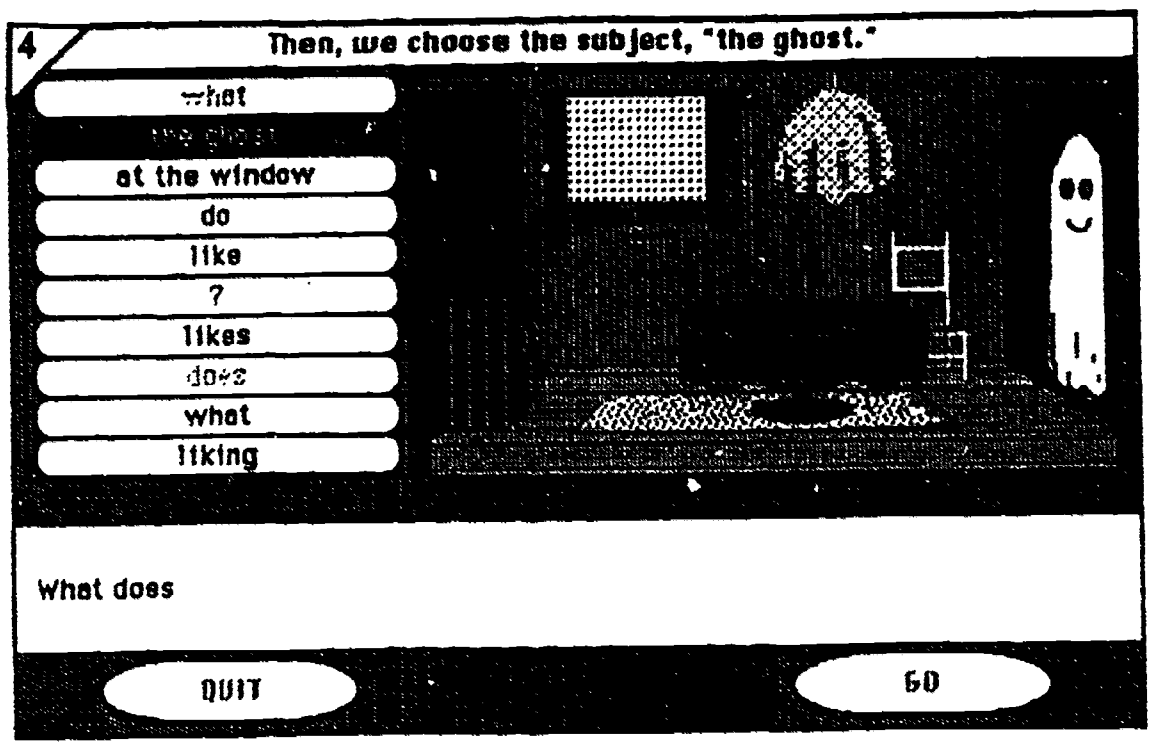
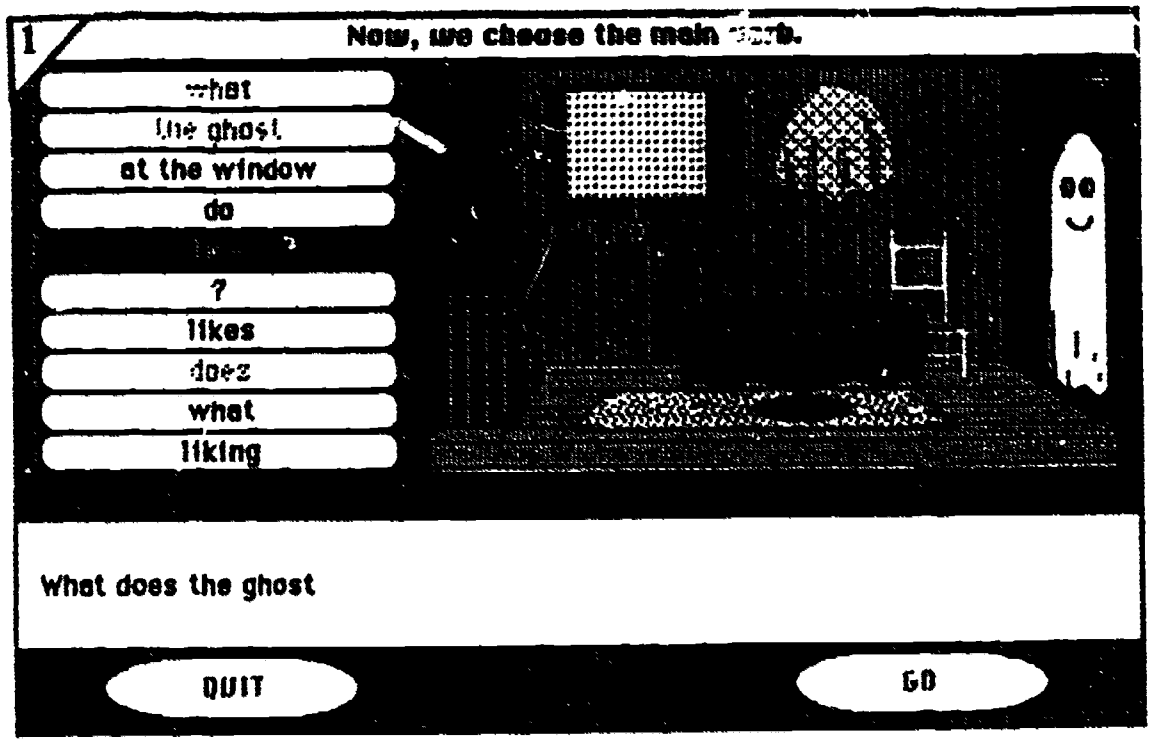
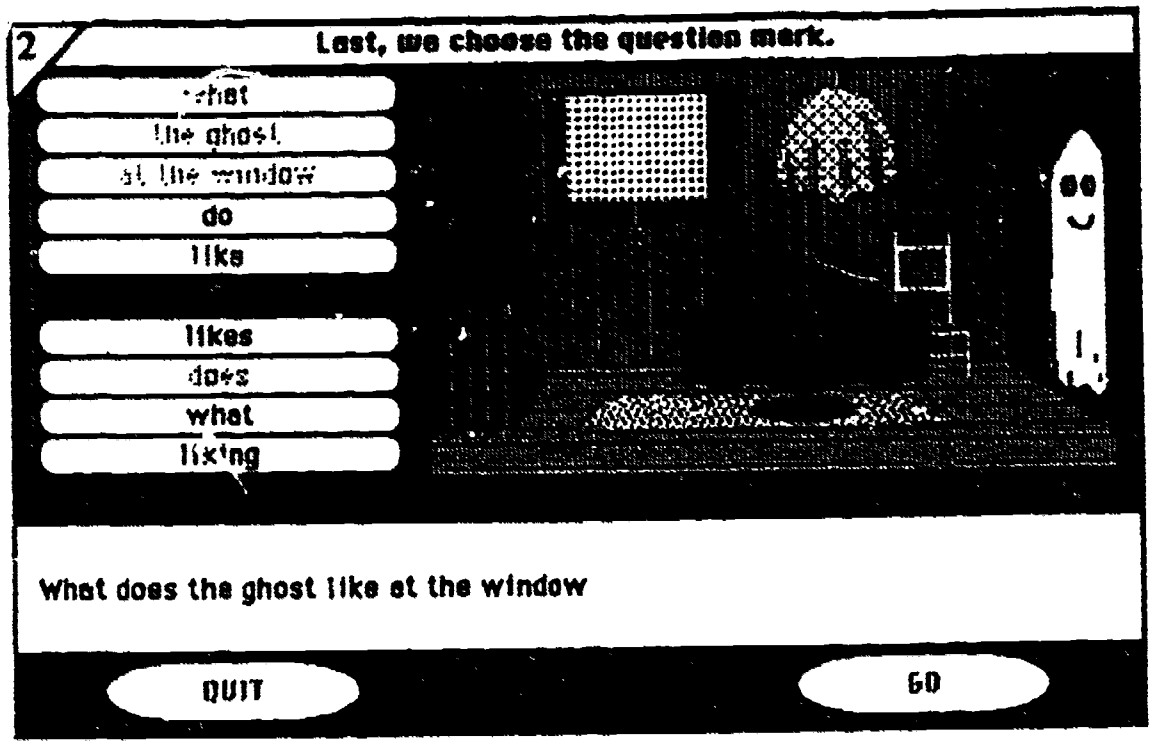
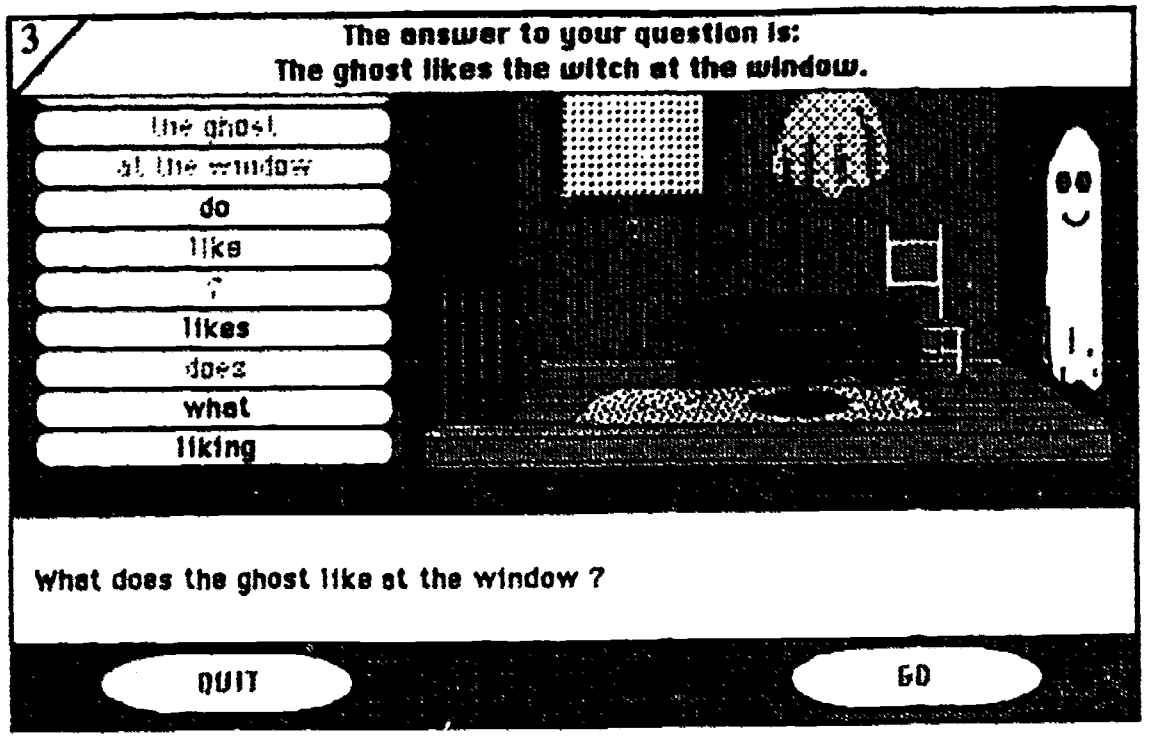


Figure 4a. Building a WH-Question







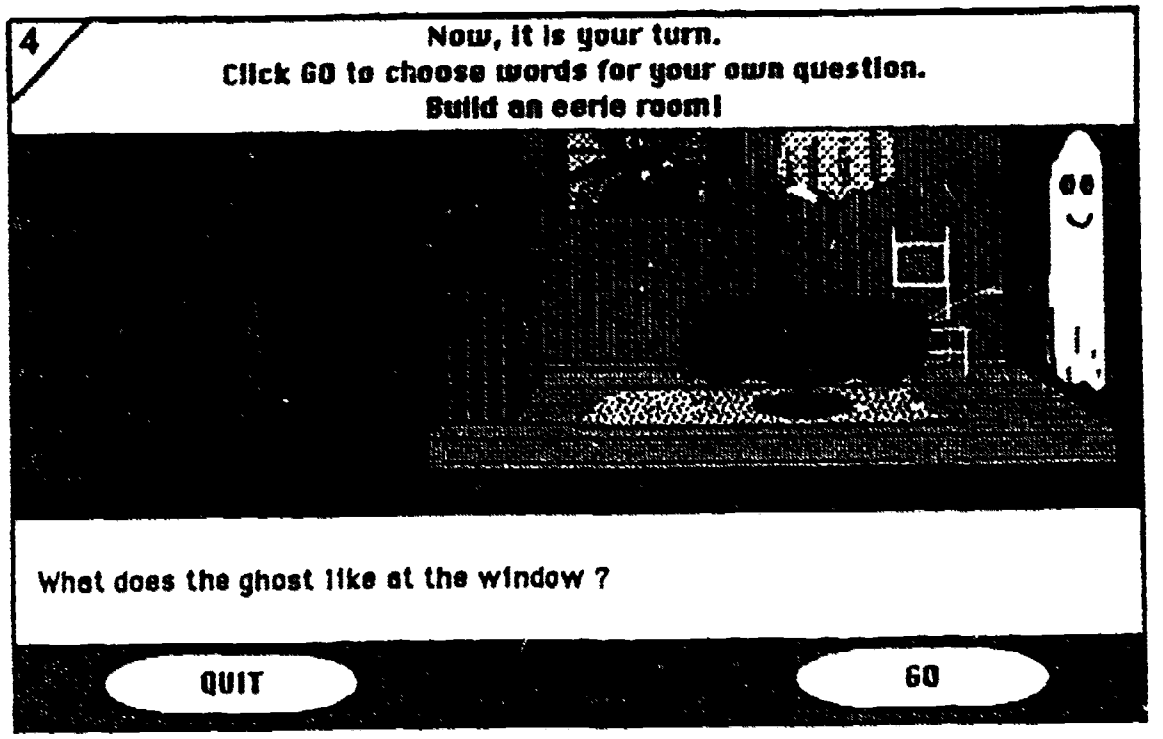
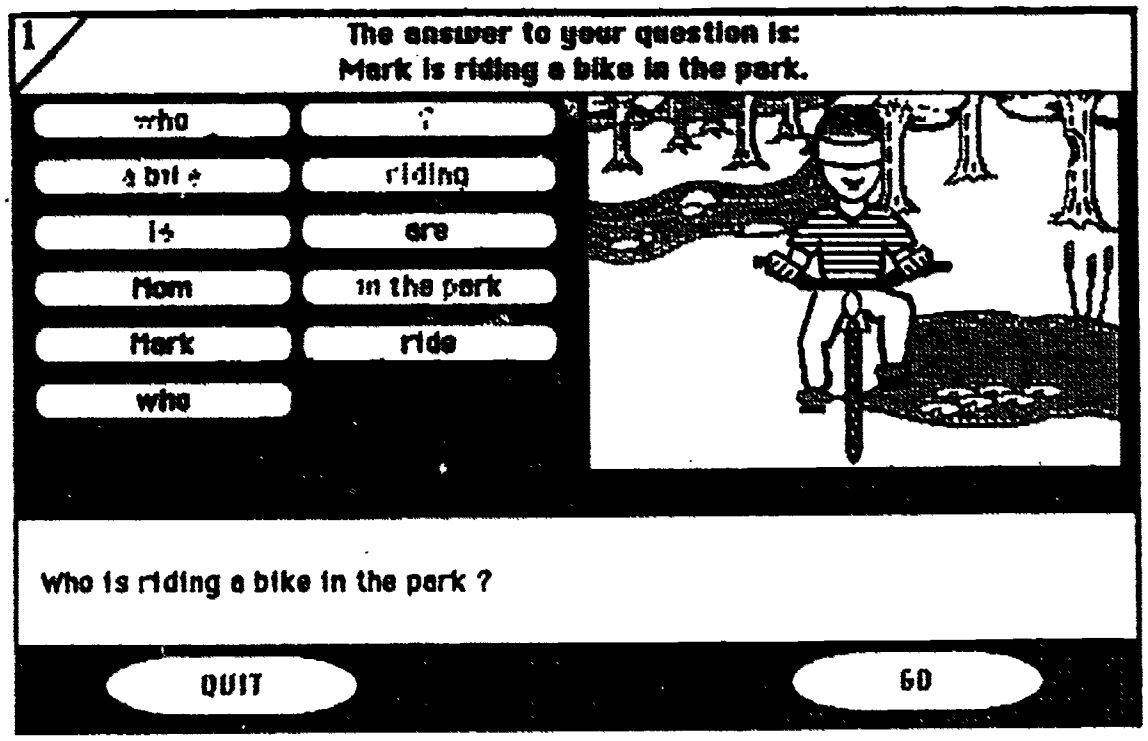
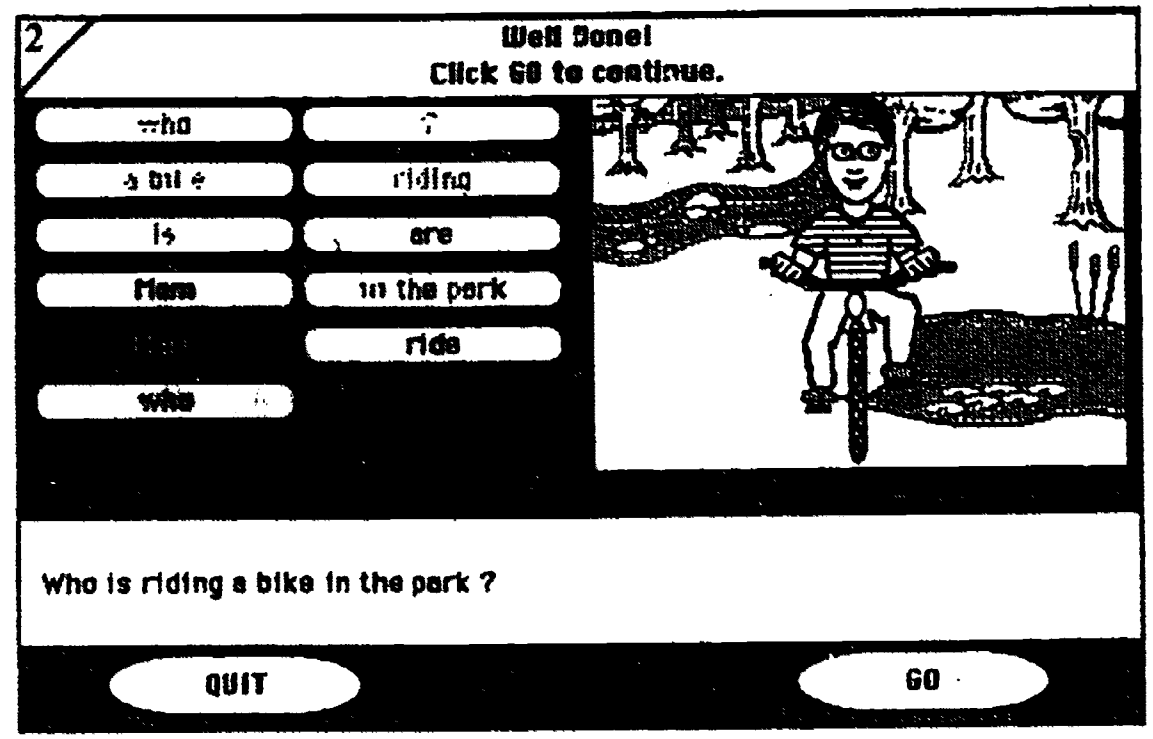
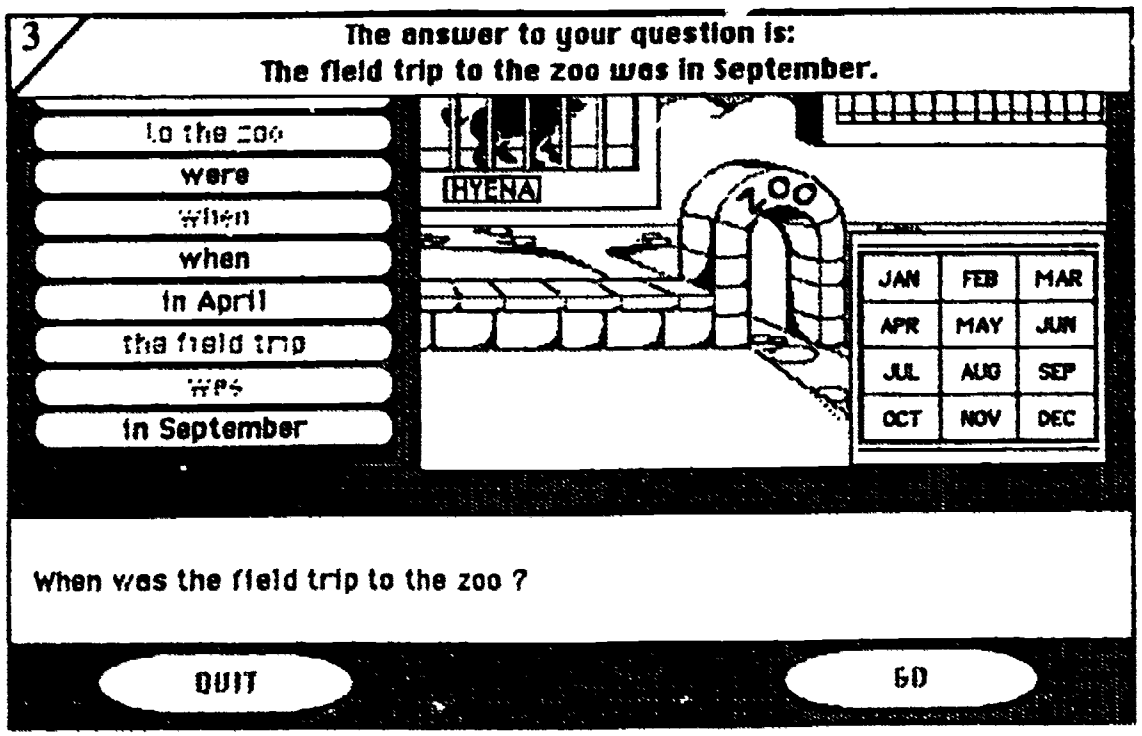


Figure 4b. Building a WH-Question







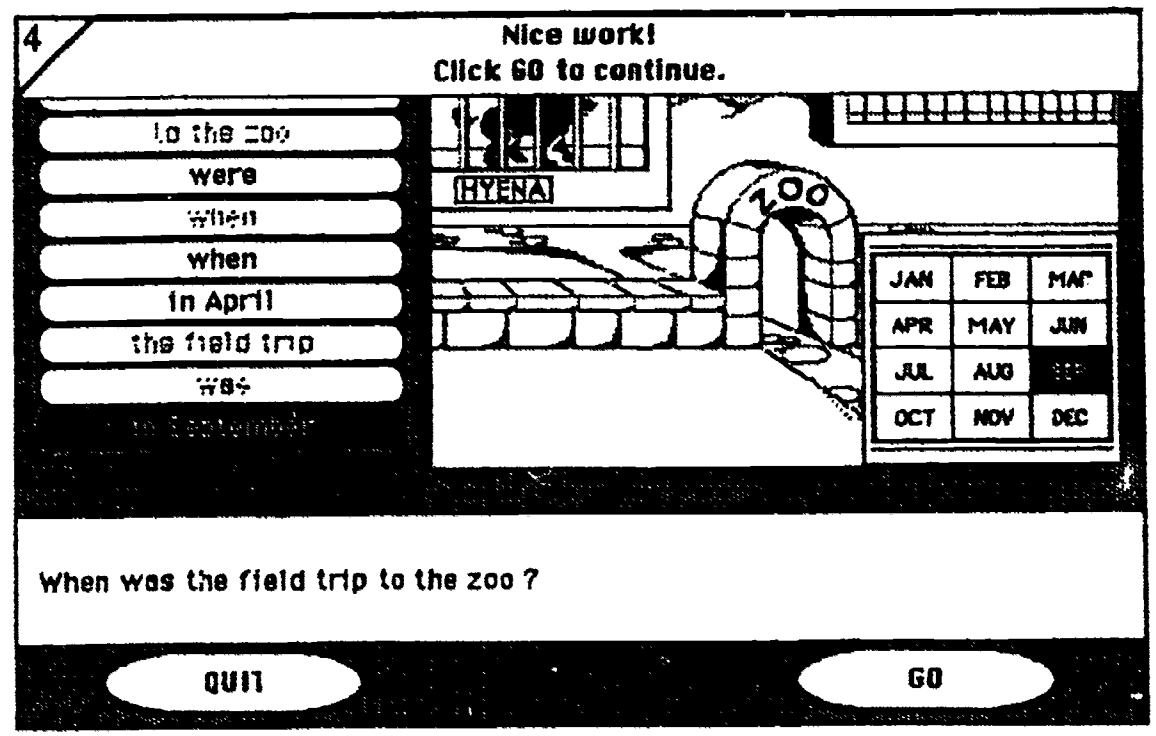
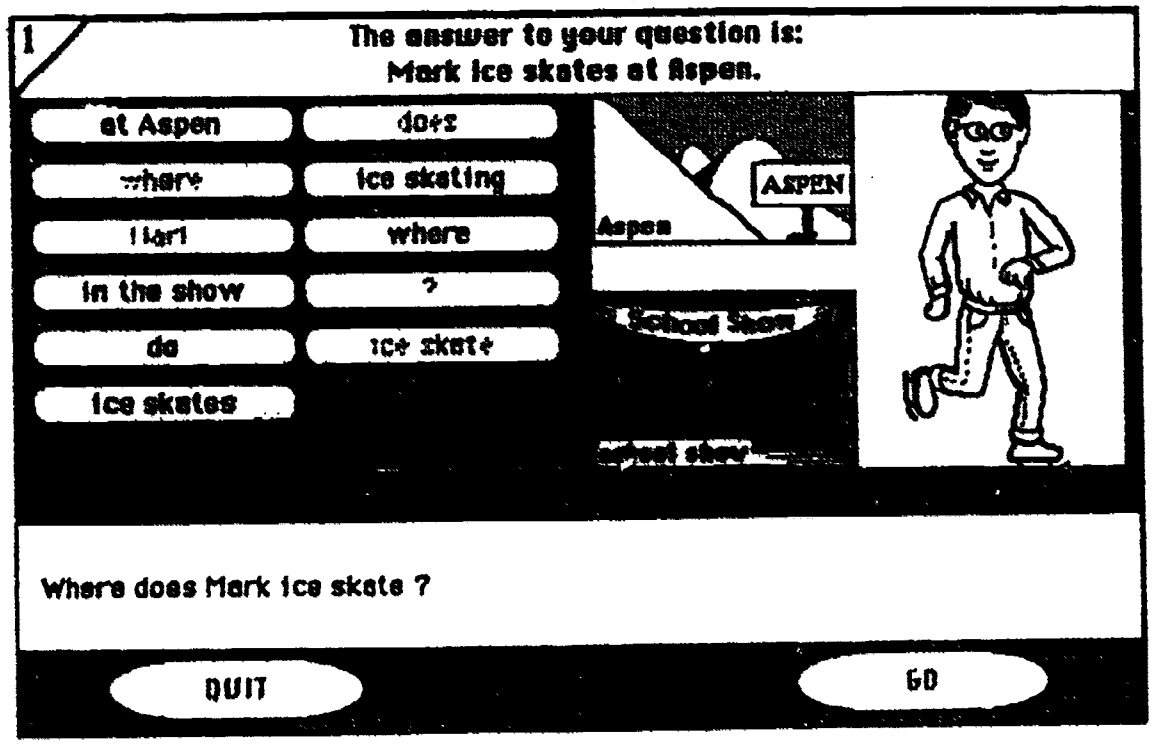
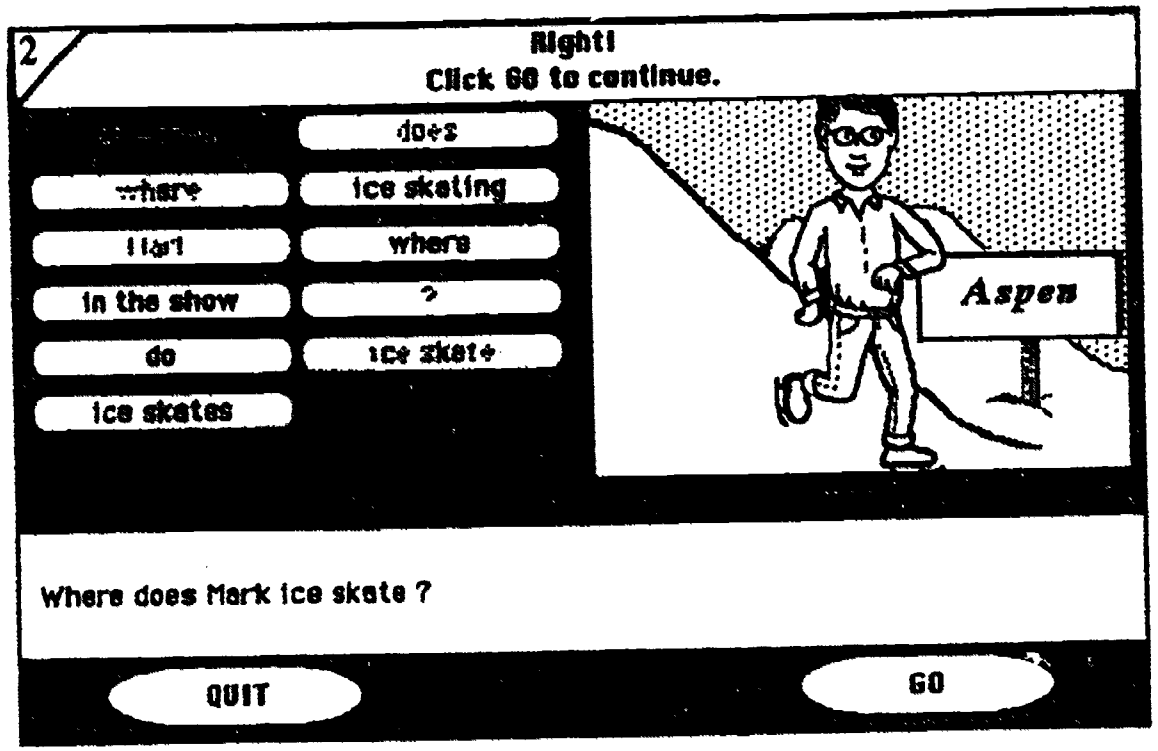
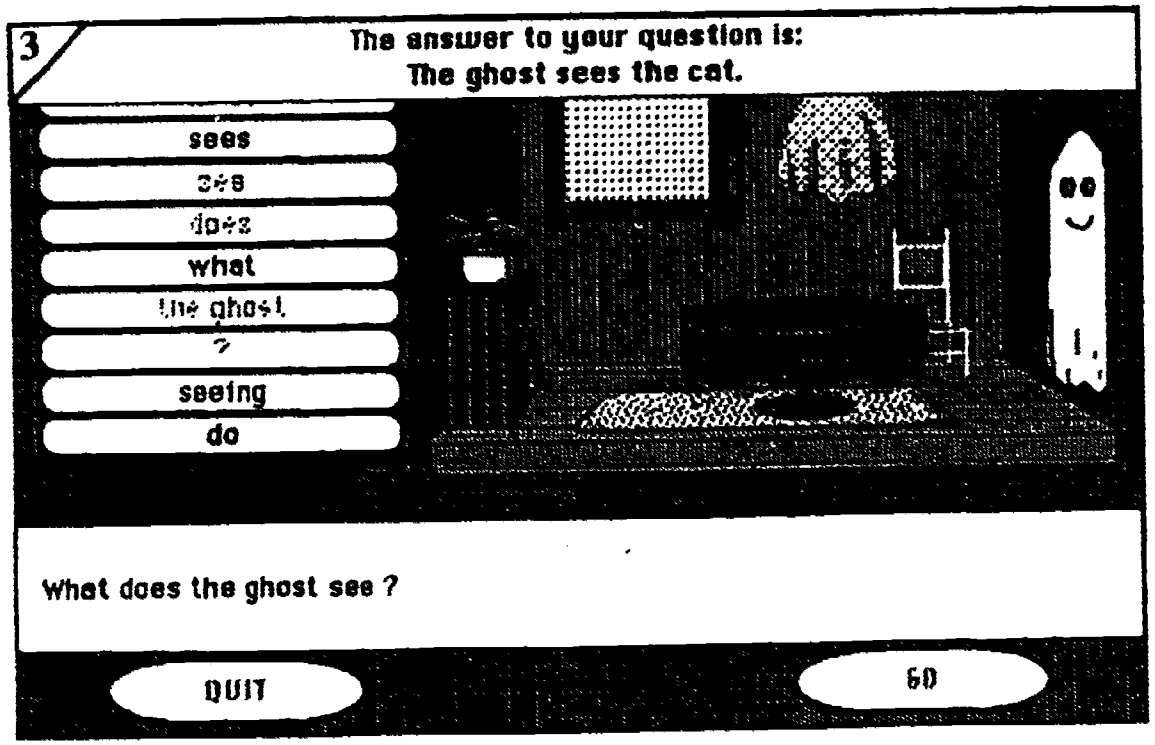


Figure 5. Finding the Answer in the *WHO* and *WHEN Games*







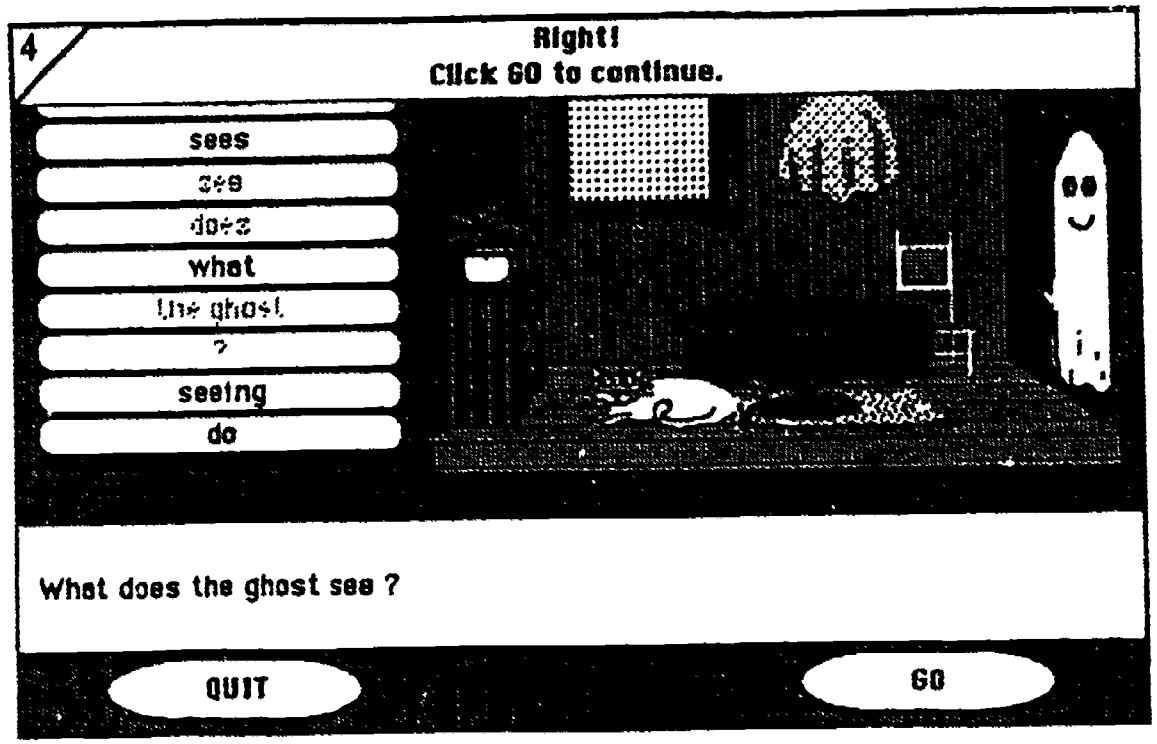


Figure 6. Finding the Answer in the *WHERE* and *WHAT Games*

in the word boxes flashes, and the corresponding small picture displayed in the picture box is enlarged to fill the picture box as a full background. The *WHAT Game*, different from the three preceding games, allows students to build an eerie room; each time a student builds a correct *WHAT* question, the word box with the answer flashes, and an object (the *WHAT*) is added to the room. Questions are built and objects are added; when the room is complete, the student may create another eerie room by building more difficult questions.

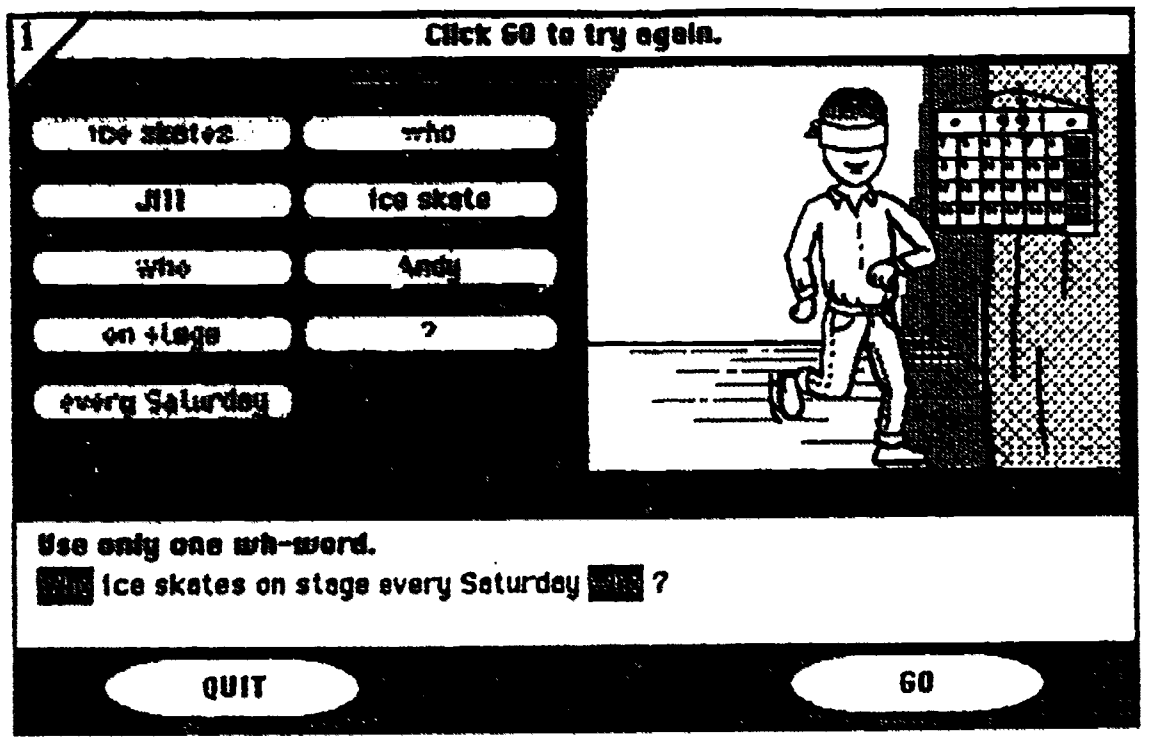
Error Feedback and Record Keeping

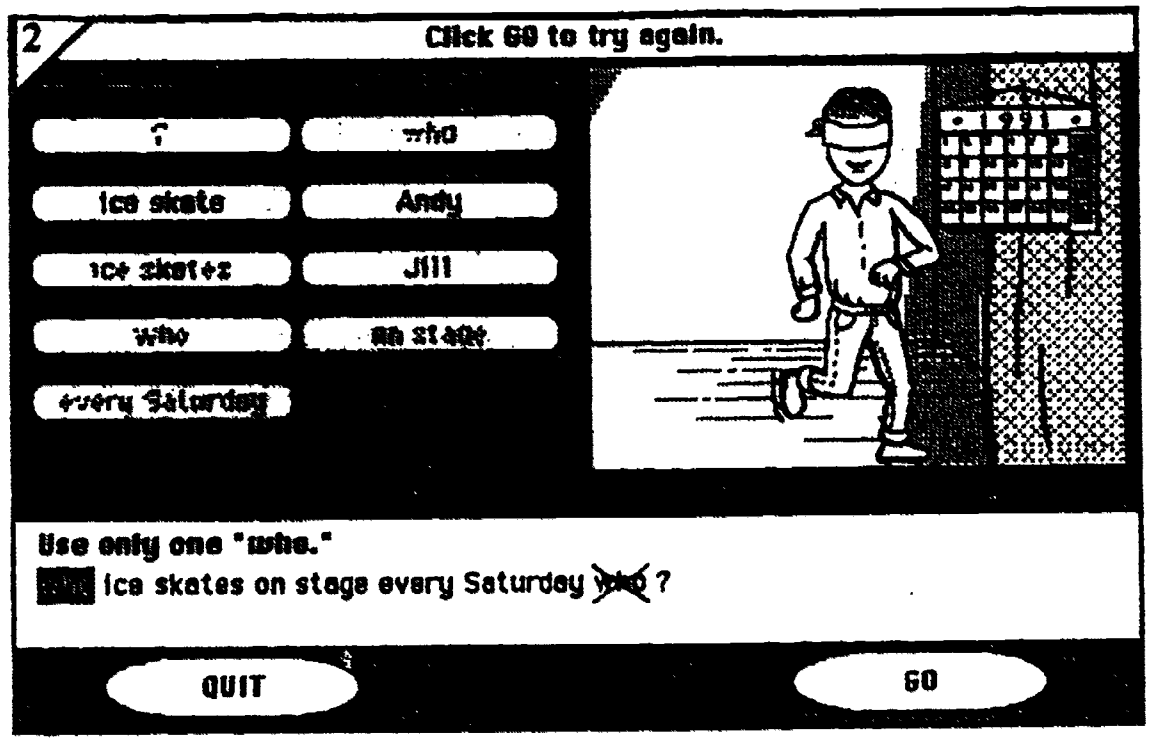
Multiple opportunities for initiating interactive practice are provided. Students have as many as 10 opportunities to build each question; for each attempt, learners benefit from detailed, corrective feedback for approximately 40 errors. The feedback is designed to provide specific visual and written responses for each type of error. A first incorrect try results in a written and visual hint; a second incorrect attempt in the same error category provides more specific, textual and visual information. If the student cannot correct the mistake, the student's incorrect question is displayed while the correct question is built above so that the student can compare the two.

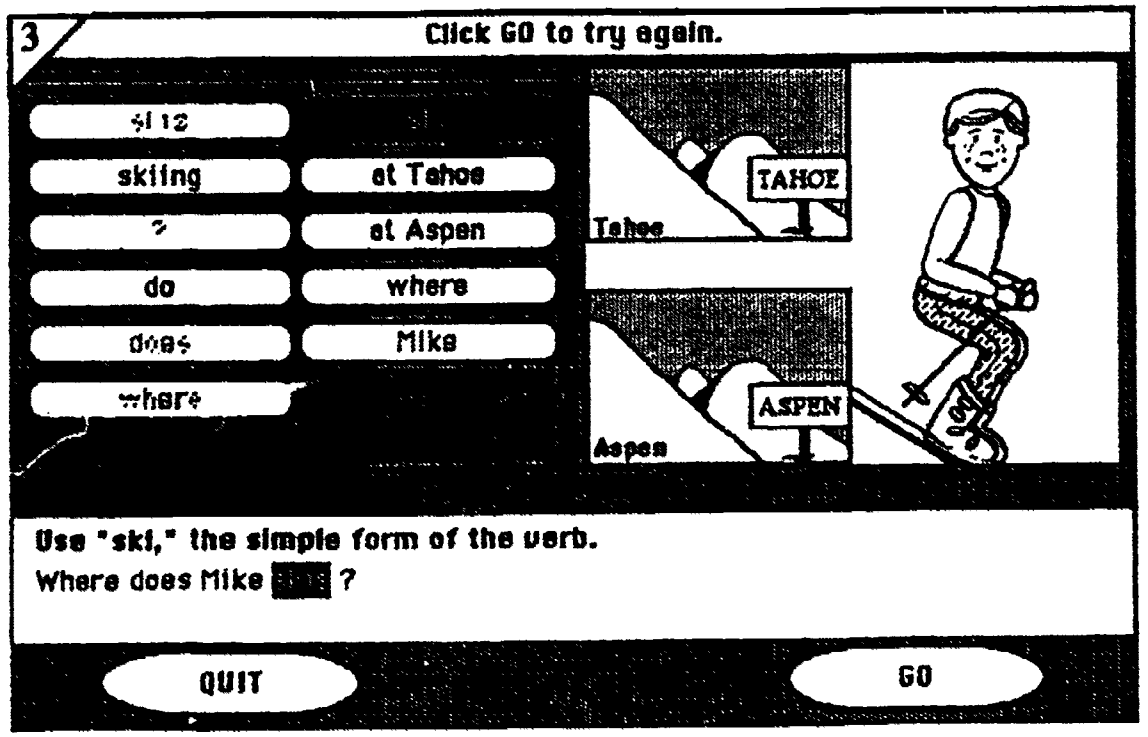
Brief, linguistically controlled messages respond specifically to the likely misunderstandings that lead to students' common errors: (1) omitted, incorrect, misplaced, or repeated auxiliary, (2) double marking the tense on both the auxiliary and main verb, and (3) incorrect word order. Of equal or greater importance is the visual feedback that responds specifically to the likely misunderstanding that led to the student's error (see Figures 7a and 7b). For example, for the use of an incorrect auxiliary verb, the error is highlighted in the student's question while its correct counterpart is flashed slowly in the word matrix, and its correct place in the question is indicated by a flashing arrow. If a student "double marks" the tense of the verb, visual feedback includes highlighting the verb first, and placing an "X" over the incorrect suffix later.

Originally, provision to review structural modeling was built into the prototype for instances when the specific, corrective feedback was insufficient to correct misunderstandings; however, because the immediate feedback proved so effective that none of the subjects ever triggered the more detailed modeling reviews, the additional structural modeling was not included in the *Question Game*. The success of the feedback can probably be attributed to its visualization; the instructional program used video "effects" such as flashing, highlighting, and reverse video to emphasize instructional points.

To facilitate data collection, and to provide a record of the students' performance, a record keeping module was integrated in the *Question Game*. A continually updated record of correct and incorrect responses, and a detailed history of every response (e.g. each click of the ERASE button, and the resulting question built) in the syntactic practice, were designed to be converted to text files for later analysis by the teacher. (See Appendix 2.)







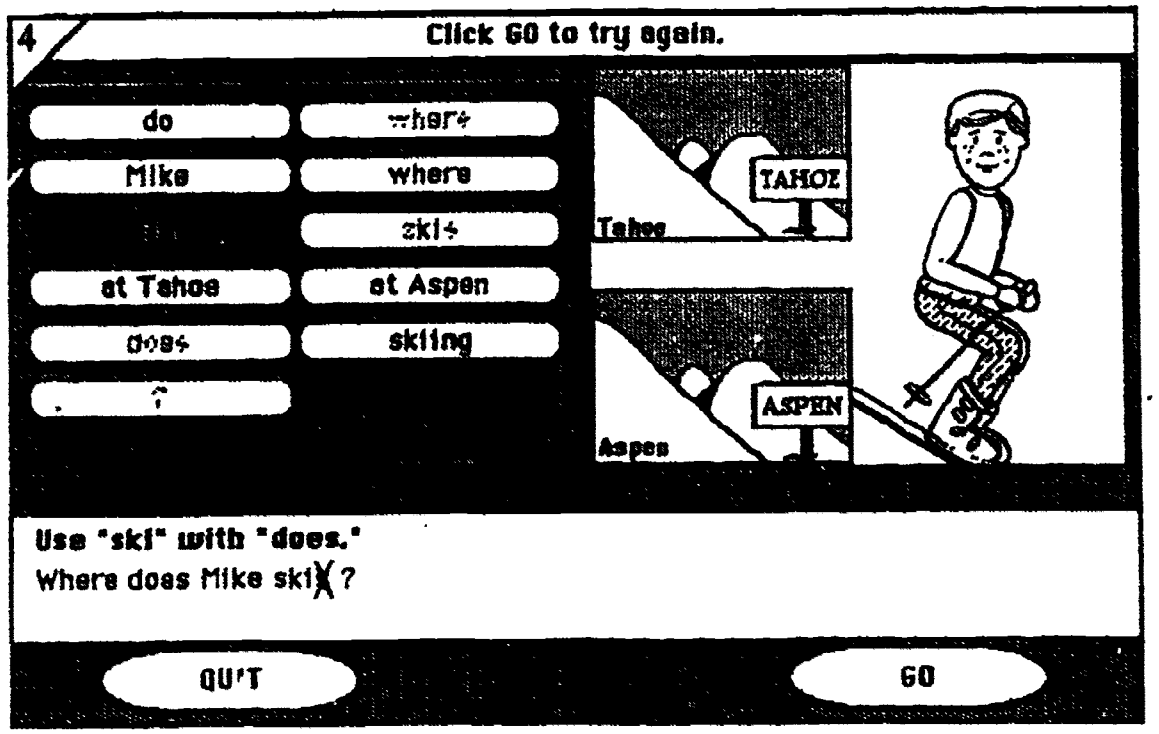
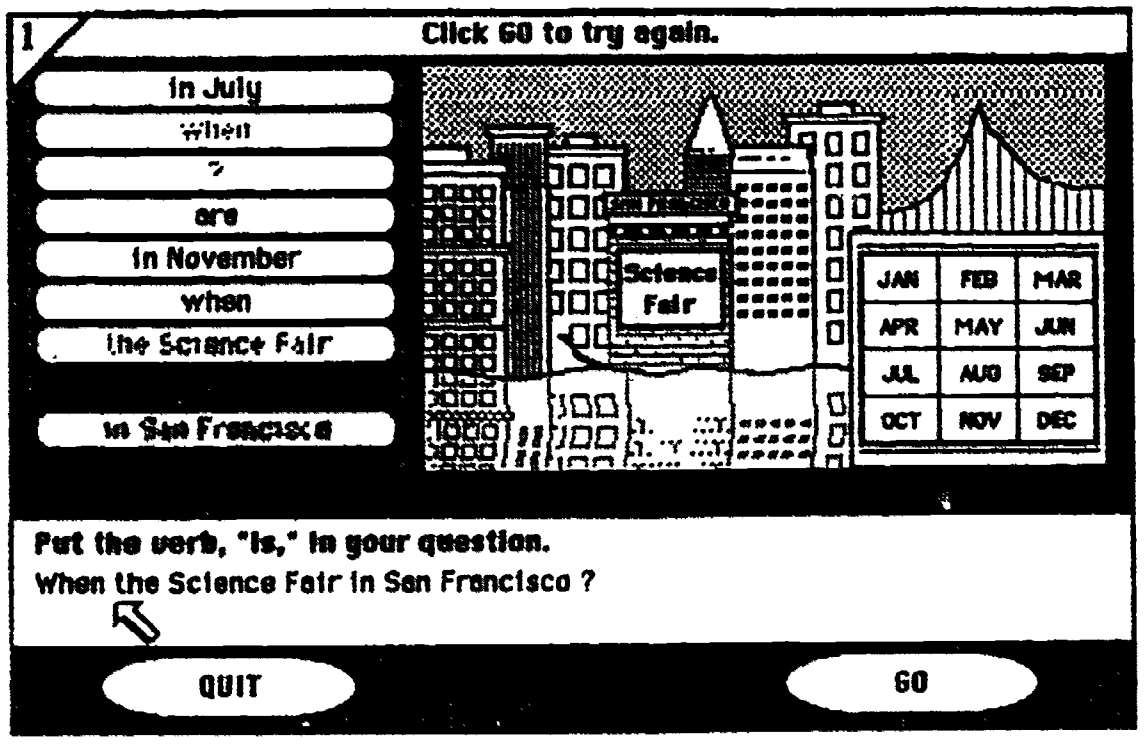
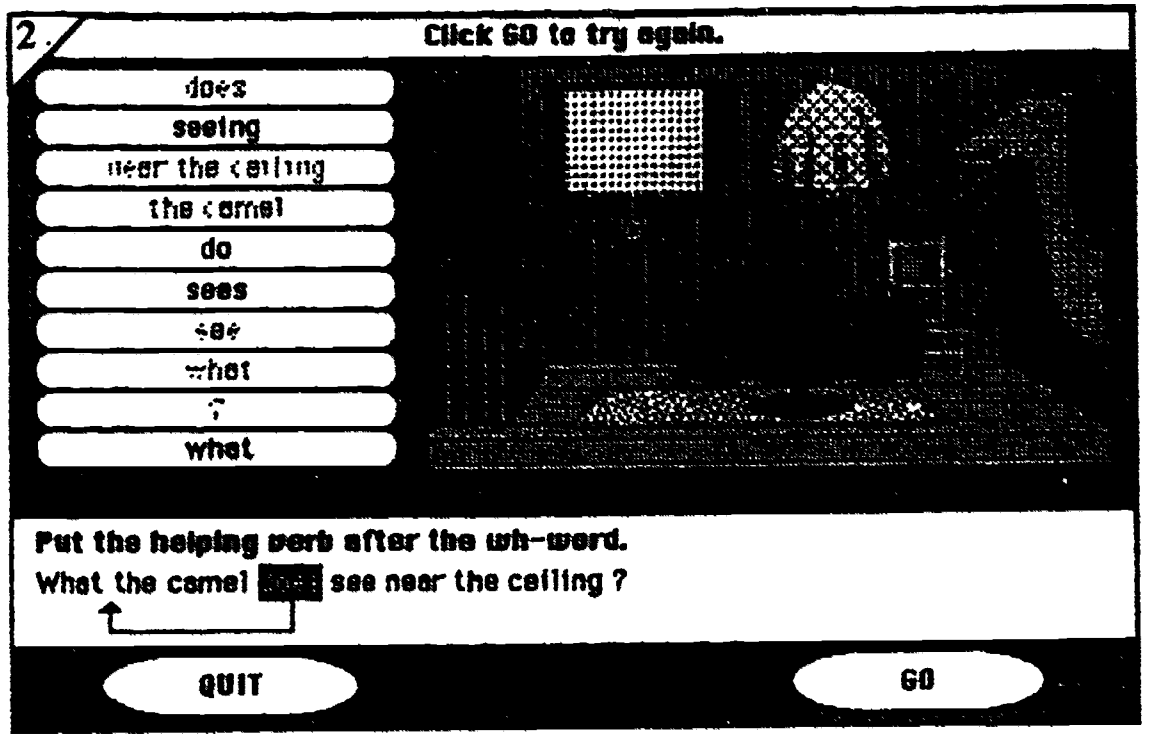
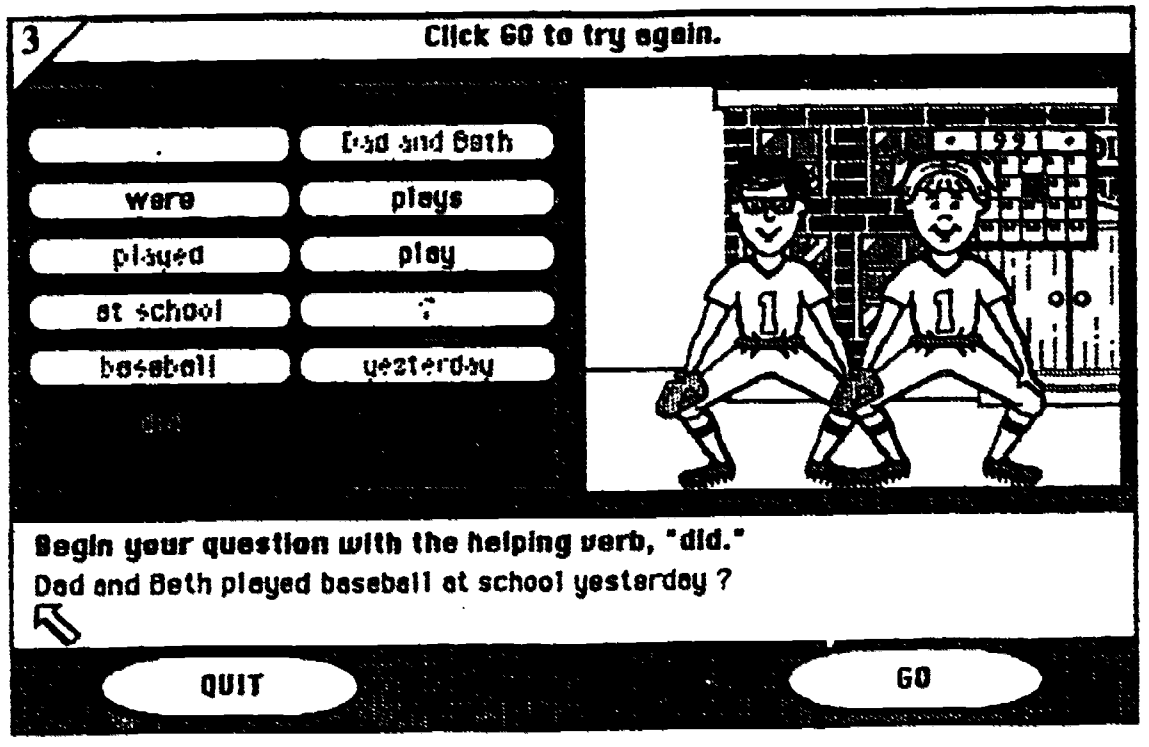


Figure 7a. Visual and Textual Corrective Feedback







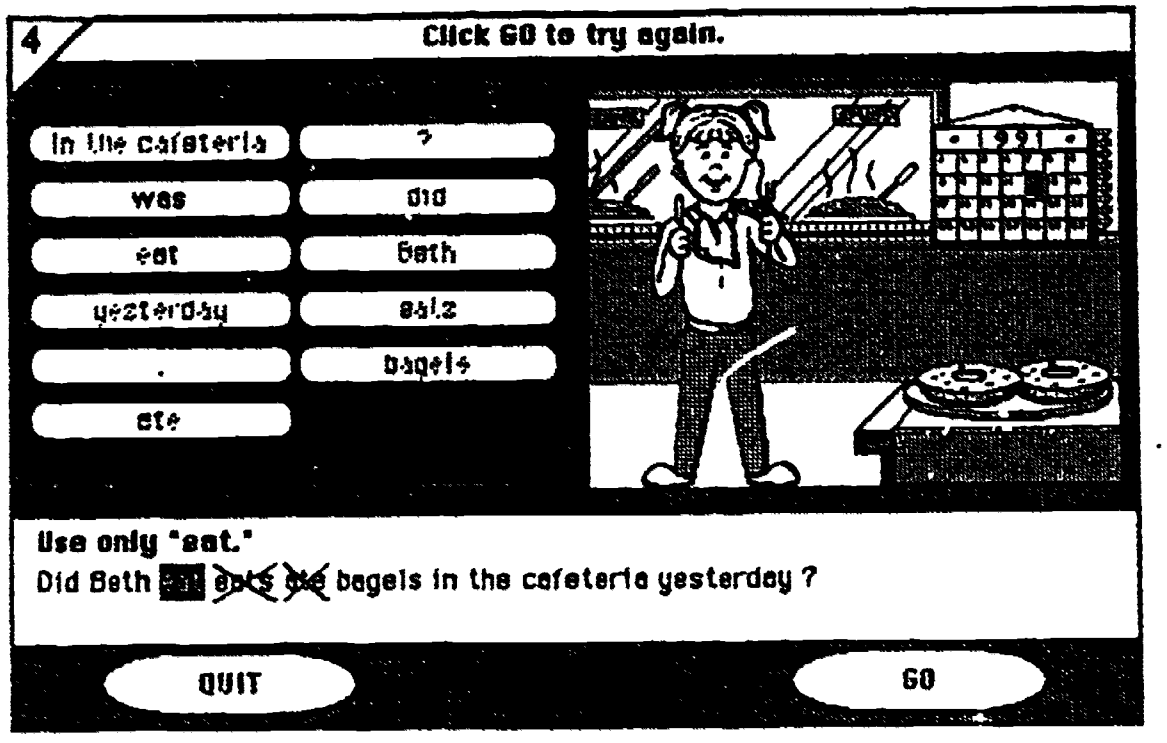


Figure 7b. Visual and Textual Corrective Feedback

3. *The Question Game* Study: Building WH and Yes-No Questions

The CAI treatment, *The Question Game* , was composed of 17 lessons which could be completed by an average subject in approximately five to six class periods (4 hours) Students proceeded through *The Question Game* individually; the learner controlled the pace.

Sample

The teaching materials were evaluated through their use by two groups of students in a School for the Deaf. Group A consisted of 8 students (2 male, 6 female) at the 7th/8th grade level; Group B, at the 4th/5th grade level, was composed of 9 students (5 male, 4 female). Because one of the female students in Group A did not take the final evaluation test, none of her test scores are included in the statistics involving comparison of repeated measures. Evidently by oversight, a female student in Group B failed to complete the second part of an essential evaluation test (Part II of Test 2, see below). Thus, none of her test scores could be included in pre/post treatment comparisons involving mean scores on Part II of the test. For some of the statistics concerning the evaluation of the materials, the total number of students involved is therefore only 15 (Group A = 7, Group B = 8, Males 7, Females 8). Although at a higher grade level, Group A was evidently at a somewhat lower English proficiency level than Group B, as is shown by their pre-test performance (see below).

Methodology and Test Construction

Evaluation design - The original plan for evaluating the materials had called for a two phase intervention in which the students using the materials would be paired off on the basis of reading scores and pretest results to form two groups, each of which were to be used alternately as experimental and control groups. The first group was to receive the training while the second group was to be exposed to a placebo treatment. After administration of the final post-test, the treatments were to be reversed: placebo treatment for the first group and training for the second group before the administration of a second and final post-test.

Unfortunately, the relatively small number of subjects available for evaluation, as well as administrative difficulties involved in splitting the students into paired groups for treatment purposes, made it impossible to follow through with this design. Fortunately, a similarly designed project and experiment utilized for the evaluation of the materials dealing with Yes and No Questions had already demonstrated that with the type of students, materials, and tests involved in the projected evaluation, the chances for improvement in test scores being influenced by test learning and/or Hawthorne effects are practically nil (Fogel, 1990). It was therefore decided to base the evaluation of the material on a simple pre- and post-test design involving both groups. Since the treatment consisted of the administration of a shortened version of the previously

developed material dealing with Yes/No Questions, as well as the presentation of the newly constructed Wh- Question program, one version of the post test was interpolated between the Yes/No Question and the new Wh- Question treatment in order to determine to what extent the Yes/No Question treatment contributed to the learning of the Wh-Questions.

Test Construction — Three tests (see Appendix 3) were utilized in the evaluation: a pre-test (Test 1), and two post-tests (Test 2 and Test 3) which were administered after the presentation of the Yes/No Question materials (Test 2), and after teaching the newly designed Wh- Question program (Test 3). Tests 1, 2, and 3 were basically identical, insofar as all tests used the same format and the same grammatical structures and distraction types. With one minor exception (see below) they were differentiated only by the vocabulary (nouns, verbs, adverbs) used in the test items, and by some variation in the sequence of item presentation.

Each test consisted of two parts (Part I, Part II). Part I, which was designed to test recognition rather than production, was composed of 25 multiple choice items; each presented a correct Wh- question and three incorrect distractors. Of the 25 items, seven involved *Who*, eight dealt with *What*, six with *Where*, and four with *When*. The reliabilities of Part I of Tests 1, 2, 3 (as expressed by the coefficient Cronbach's alpha) were 0.44, 0.73, and 0.64. These coefficients are certainly high enough to guarantee reliable measurement for purposes of group comparisons. The relatively lower reliability for Test 1 can be explained by the fact that some slight modifications were made for Tests 2 and 3; four items in Test 1 which had been answered correctly by all students were reworked. In Tests 2 and 3 these items were made slightly more difficult by the inclusion of patterns involving adverbial placement. It should also be noted that Tests 2 and 3 being slightly more difficult than Test 1 would, of course, tend to diminish rather than increase gains made from Test 1 to Tests 2 and 3 as a result of treatment (see 3a below).

Part II, which was designed to evaluate actual production, involved presentation of two short prose passages. Each was followed by the instruction to complete five questions relating to the passage. For each question the choice of Wh-word was specified. Thus, Part II consisted of the production of ten Wh- questions (three *Who*, three What, two *When*, and two *Where*). The reliability of Part II for the three consecutive test administrations was 0.68, 0.78, 0.85 (expressed as Kuder-Richardson split half reliability calculated on the basis of Spearman rank correlations).

Error Patterns — Since in the earlier experiment dealing with Yes/No questions the observation of error patterns had proven to be of interest, an error analysis scheme to be used in the evaluation of test results was built into the construction of Part I of the test in such a way that each of the 75 distractors used (3 in each of 25 items) contained only one specific grammatical error. The distractors utilized were based on the experience gained from the evaluation of the test used in the Yes/No Question experiment (Fogel, 1990 & 1989) and particularly on the error types

identified by Quigley in his fundamental work concerning the syntactical problems typical of Deaf usage (Quigley, 1978). The categories utilized, as well as the frequency of their utilization in Part I of the test, are shown on Table 1.

Table 1. Types of Errors Used as Distractors in Part 1 of the Tests

Type of Error s Used as Distractor	Frequency of Use of each Type of Error
1. Word Order	
1a Wh - word embedded	6
1b Wh - word at end	5
1c Subject / main verb reversed	5
1d Object / main verb reversed	4
1e Subject / auxiliary reversed	5
1f Place / time adverbials reversed	5*
2. Verb Forms	
2a Present for past or past for present (is / was, are / were, do, does / did)	5
2b Singular for plural or plural for singular (is / are, was / were, do/ does, walk / walks)	5
2c Wrong auxiliary (do for be or be for do)	6
2d Simple /-ing form, simple /-ed form, simple /-s form, -ed / -ing form (or reverse)	6
3. Repeated "be", main verb or auxiliary	5
4. Noun "copying"	4
5. Omissions	
5a Main verb omitted	3
5b Auxiliary omitted	
5b1 Simple omission	6
5b2 Omission + overmarked main verb	2
6. Added auxiliary (do or be) / Superfluous auxiliary	3

* Not utilized in test 1

Results

Part I (Multiple choice test) — Part I of the test was evaluated by error counts of individual student tests. (Because the 25 items of the test were all of the multiple choice type, the possible range of scores was from 0 to 25). Mean scores achieved by Group A are shown on Table 2 and visually compared on Figure 8. Table 3 shows the significance of differences between the mean

Table 2. Group A: Means for Tests 1, 2, and 3

X_1 : Test 1

Mean:	Std. Dev.:	Std. Error:	Variance:	Coef. Var.:	Count:
7	2.449	.926	6	34.993	7

Minimum:	Maximum:	Range:	Sum:	Sum Squared:	# Missing:
3	10	7	49	379	0

X_2 : Test 2

Mean:	Std. Dev.:	Std. Error:	Variance:	Coef. Var.:	Count:
5	3.83	1.447	14.667	76.594	7

Minimum:	Maximum:	Range:	Sum:	Sum Squared:	# Missing:
0	11	11	35	263	0

X_3 : Test 3

Mean:	Std. Dev.:	Std. Error:	Variance:	Coef. Var.:	Count:
2.143	1.952	.738	3.81	91.084	7

Minimum:	Maximum:	Range:	Sum:	Sum Squared:	# Missing:
0	5	5	15	55	0

scores of Tests 1, 2, and 3. It is obvious that the administration of the Yes/No materials, as well as that of the Wh- questions, resulted in a significant drop in the number of errors committed by the students. The effect of the entire training (Yes/No plus Wh-questions) is especially impressive: the mean drops from 7 to 2.14. While with a very small number of subjects, results shown by the use of a parametric statistic like the mean must be interpreted cautiously, confidence in the results is reinforced by the fact that all of the students of Group A had their lowest error scores in the administration of Test 3.

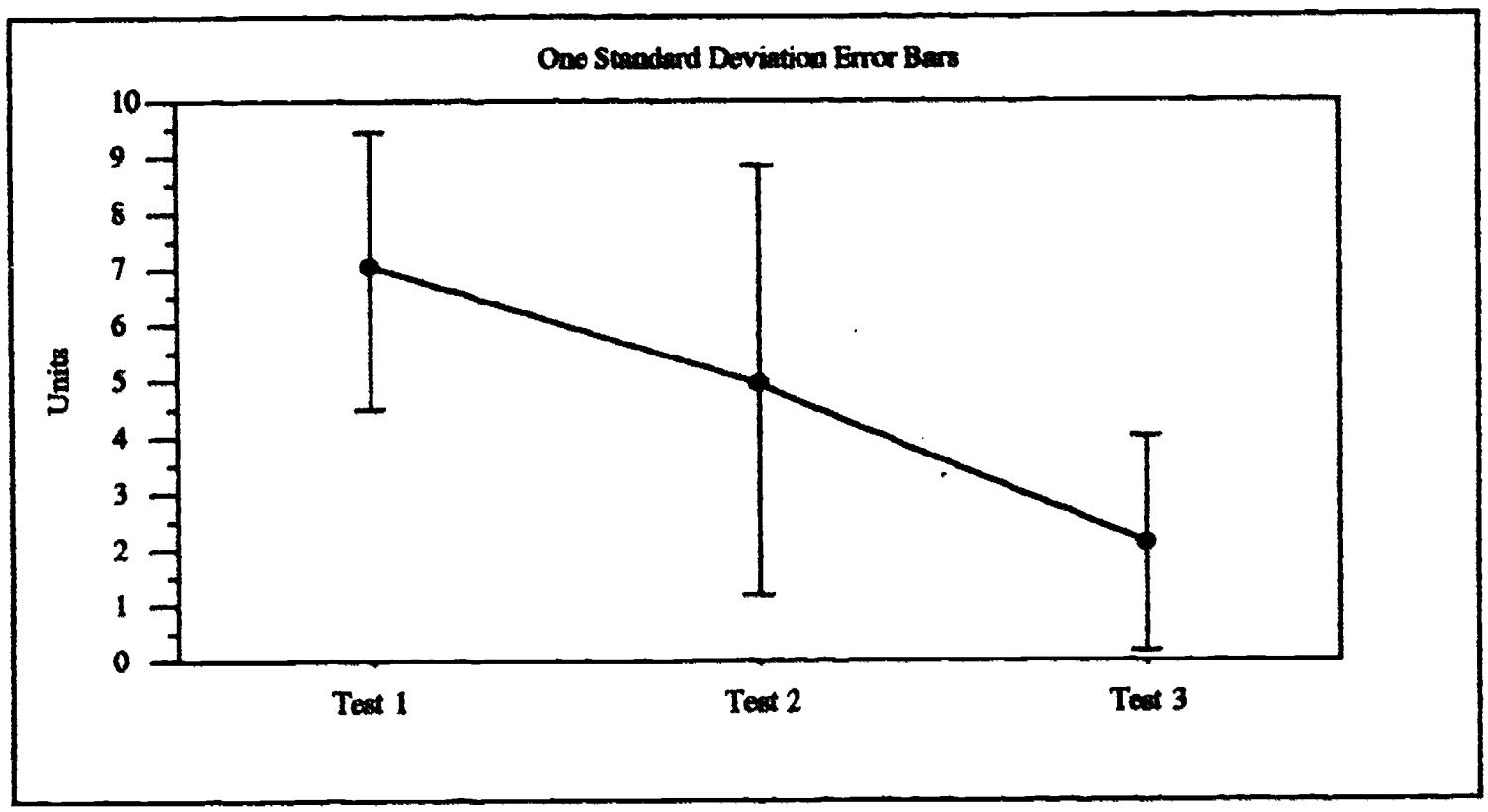


Figure 8. Group A: Means for tests 1,2 and 3

Table 3. Group A: T-Test Comparing Means of Part 1 of Tests 1, 2, and 3

Paired t-Test X_1: Test 1, Y_1: Test 2

DF:	Mean X - Y:	Paired t value:	Prob. (2-tail):
6	2	2.449	.0498

Paired t-Test X_1: Test 2, Y_1: Test 3

DF:	Mean X - Y:	Paired t value:	Prob. (2-tail):
6	2.857	3.447	.0137

Paired t-Test X_1: Test 1, Y_1: Test 3

DF:	Mean X - Y:	Paired t value:	Prob. (2-tail):
6	4.857	12.021	1.0000E-4

Results of the administration of Part I of the test for Group B are shown on Table 4 and visually presented on Figure 9. The pattern of successive lowering of means of errors is the same

Table 4. Group B: Means for Tests 1, 2, and 3

X_1 : Test 1

Mean:	Std. Dev.:	Std. Error:	Variance:	Coef. Var.:	Count:
5.222	1.986	.662	3.944	38.031	9

Minimum:	Maximum:	Range:	Sum:	Sum Squared:	# Missing:
3	8	5	47	277	0

X_2 : Test 2

Mean:	Std. Dev.:	Std. Error:	Variance:	Coef. Var.:	Count:
4.222	2.539	.846	6.444	60.125	9

Minimum:	Maximum:	Range:	Sum:	Sum Squared:	# Missing:
1	7	6	38	212	0

X_3 : Test 3

Mean:	Std. Dev.:	Std. Error:	Variance:	Coef. Var.:	Count:
3.333	2.693	.898	7.25	80.777	9

Minimum:	Maximum:	Range:	Sum:	Sum Squared:	# Missing:
0	9	9	30	158	0

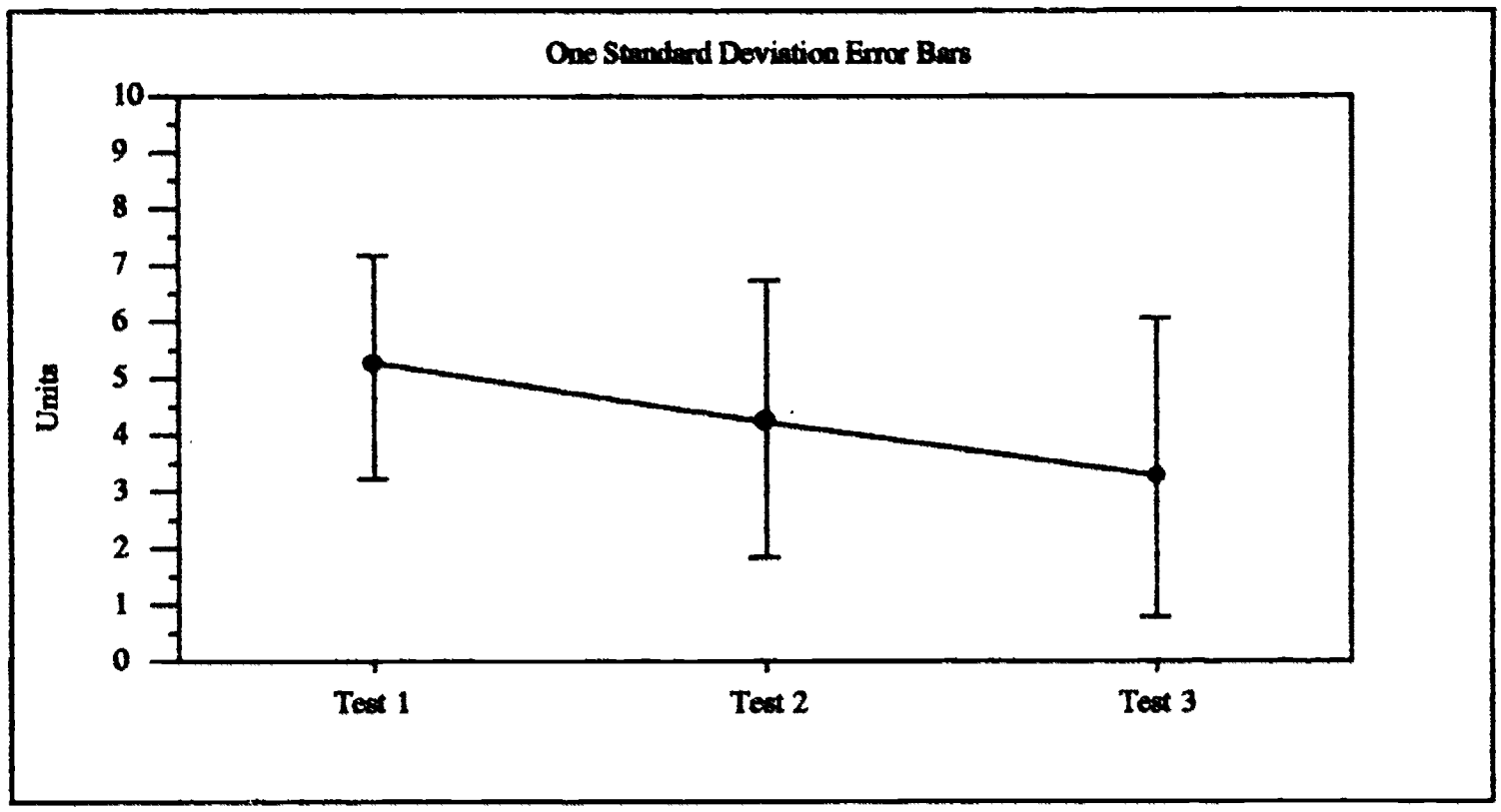


Figure 9. Group B: Means for tests 1,2 and 3

as for Group A. The main differences are that Group B starts with a relatively lower (i.e. better) score than Group A, and that lowering of error scores from Test 1 to Test 2 and Test 2 to Test 3 does not reach significance levels. However the crucial differences between Test 1 and Test 3 (means of 5.22 and 3.33), in other words the effect of the administration of the whole set of materials, is again significant (Table 5). The number of students (8 out of 9) taking part in this lowering of errors reinforces again the confidence in this statistic.

Table 5. Group B: T-Tests Comparing Means of Part 1 of Tests 1,2, and 3

Paired t-Test X_i: Test 1, Y_i: Test 2

DF:	Mean X - Y:	Paired t value:	Prob. (2-tail):
8	1	1.414	.195

Paired t-Test X_i: Test 2, Y_i: Test 3

DF:	Mean X - Y:	Paired t value:	Prob. (2-tail):
8	.889	1	.3466

Table 5 (Continued). Group B: T-Tests Comparing Means of Part 1 of Tests 1,2, and 3

Paired t-Test X_1: Test 1, Y_1: Test 3

DF:	Mean X - Y:	Paired t value:	Prob. (2-tail):
8	1.889	4.857	.0013

Part II (Production test) — Part II of the test was also evaluated by an error count. Number of errors committed on each of the responses (questions) produced by individual students ranged from 0 to a possible (but rarely reached) maximum of 3. The range of possible test scores was therefore from an optimal 0 to a theoretical, though fortunately never produced, 30. What was less fortunate was that the administration of the training seemed to have no measurable effect on productive ability as shown in Part II of the test. The mean scores of Tests 1, 2, and 3 for Group A were 5.00, 6.00, 5.85. The comparable scores for Group B (again shown to possess slightly better English skills) were 3.50 for each test administration. Of the 16 students (Groups A and B) taking part in the administration of Part II of the test, only half demonstrated better scores on Test 3 than on Test 1. Evidently, the treatment used, i.e. the abbreviated version of the Yes/No and the Wh- material, was not intensive enough to make a detectable overall difference in the ability to produce error-free wh-questions.

Error analysis - - The error analysis addressed basically two questions: (1) what is the relative difficulty of the types of questions (*Who, What, Where, When*) and (2) what is the relative frequency of the error categories used in the distractors of Part I and also utilized in the error analysis of Part II of the tests?

The answer to question (1) above is provided on Table 6. In inspecting the table, one has to keep in mind that the numbers shown for Part I are not directly comparable with those indicated for Part II of the test. The figure of 0.16 for "*Who*: Group A Part I" is determined in the following way: first, the total number of wrong choices made by all students of Group A in all of the *Who* questions on the test is established (9 errors in the *Who* questions of Part I). This number is then divided by the total number of opportunities to make an error in *Who* questions (7 *Who* question items x 8 students = 56): 9/56 = 0.16. The figures for item difficulty for Part I can thus be interpreted as a percentage: in 16% of all of the *Who* items on Part I of Test 1, the students of keep in mind that the numbers shown for Part I are not directly comparable with those indicated for Part II of the test. The figure of 0.16 for "*Who*: Group A Part I" is determined in the following way: first, the total number of wrong choices made by all students of Group A in all of the *Who*

Table 6. Index of Difficulty for Question Types

Group A

	Part I*					Part II **			
	test 1	test 2	test 3	total		test 1	test 2	test 3	total
who	0.16	0.14	0.09	0.13	who	0.21	0.21	0.33	0.25
what	0.41	0.23	0.11	0.25	what	0.54	0.67	0.58	0.60
when	0.35	0.29	0.01	0.24	when	0.50	0.75	0.63	0.63
where	0.25	0.19	0.00	0.15	where	0.69	0.56	0.50	0.58

Group B

	Part I*					Part II **			
	test 1	test 2	test 3	total		test 1	test 2	test 3	total
who	0.17	0.14	0.16	0.16	who	0.19	0.11	0.19	0.16
what	0.21	0.29	0.19	0.23	what	0.30	0.30	0.30	0.30
when	0.17	0.01	0.07	0.11	when	0.50	0.44	0.50	0.49
where	0.17	0.14	0.03	0.11	where	0.39	0.39	0.39	0.39

* For Part I of the test, the Difficulty Index is the total N of errors divided by the total N of opportunities to make the errors.

** For Part II of the test, the Difficulty Index is the total N of errors committed for each question type, divided by the total frequency of the question type.

questions on the test is established (9 errors in the *Who* questions of Part I). This number is then divided by the total number of opportunities to make an error in *Who* questions (7 *Who* question items x 8 students = 56): 9/56 = 0.16. The figures for item difficulty for Part I can thus be interpreted as a percentage: in 16% of all of the *Who* items on Part I of Test 1, the students of Group A chose a distractor instead of the correct example. The figures given for Part II do not represent a percentage, but rather the actual number of all kinds of errors committed by all students in a specific question type divided by the frequency with which the question type is used: e.g., the 8 students of Group A who took Part II of Test 1 made a total of 5 errors in the 3 *Who* questions required by the test. The total frequency of the question type for the group of 8 students is 24 (3 Who questions x 8 students). The relative difficulty or error frequency for *Who* questions is thus calculated as 5/24 = 0.2083 or 0.21.

Several observations can be made regarding the relative difficulty of *Who, What, Where,* and *When* constructions. For both groups, and especially in the production part of the test, *Who* questions are evidently easier than the others. This finding is not surprising because *Who* questions involve only the use/substitution of the relative pronoun (*who*) instead of a noun and do not entail other transformations from statement to question. On Part II of the test, where no overall progress was made, item difficulty also stays relatively level for all question types from Test 1 to 2 to 3. On Part I of the test, the overall progress made by all students is, of course, reflected by a decrease in difficulty of all error types for all groups as a result of total treatment (Test 1 vs. Test 3). The decrease in error difficulty is most dramatic in Group A and most pronounced in the

especially difficult *When* and *What* questions (even though Test 3 had to be administered before all of the treatment of *What* questions had been concluded).

The relative difficulty of error categories, as revealed by Part I of the test, is shown on Table 7. The number indicating the relative frequency of choice of a particular distractor type is

Table 7. Difficulty* of Error Categories, Part 1 of the Tests

Part I of Test									
Group A					Group B				
Category	Test 1	Test 2	Test 3	Total	Category	Test 1	Test 2	Test 3	Total
1a	0.00	0.00	0.00	0.00	1a	0.00	0.00	0.00	0.00
1b	0.00	0.00	0.00	0.00	1b	0.00	0.00	0.00	0.00
1c	0.00	0.05	0.03	0.03	1c	0.00	0.00	0.00	0.00
1d	0.00	0.00	0.00	0.00	1d	0.00	0.00	0.00	0.00
1e	0.20	0.13	0.05	0.12	1e	0.06	0.00	0.00	0.02
1f	*	0.03	0.03	0.03	1f	0.11	0.11	0.08	0.10
2a	0.20	0.05	0.08	0.11	2a	0.11	0.11	0.02	0.07
2b	0.48	0.03	0.03	0.18	2b	0.38	0.36	0.24	0.33
2c	0.08	0.15	0.13	0.12	2c	0.09	0.04	0.07	0.07
2d	0.25	0.19	0.04	0.16	2d	0.07	0.17	0.07	0.13
3	0.03	0.03	0.03	0.03	3	0.04	0.03	0.00	0.02
4	0.03	0.03	0.03	0.03	4	0.00	0.00	0.00	0.00
5a	0.13	0.17	0.04	0.11	5a	0.00	0.00	0.00	0.00
5b1	0.08	0.02	0.02	0.04	5b1	0.00	0.02	0.01	0.01
5b2	0.25	0.13	0.13	0.19	5b2	0.00	0.00	0.00	0.00
6	0.04	0.04	0.04	0.04	6	0.04	0.04	0.04	0.04

* The difficulty index of each category is the total N of errors (choices of distractors) divided by the opportunity of choosing the distractors (instances of use in the test times the N of students)
* Not included in Test 1 for Group A.

again the number of choices of the distractor divided by the number of opportunities. Thus in Group A, the category 2b (confusion of morphological form indicating number) is chosen a total of 19 times on Test 1. The number of opportunities to choose this distractor is the frequency with which it occurs in the test (5) times the number of students taking the test (8): 5 x 8=40. The difficulty index is 19/40 = 0.475 = 0.48. This index could again be expressed as a percentage: the students chose distractors containing this particular error 45% of the time.

It can be noted that certain distractors (e.g. 1a, 1b, which represent wrong position of the Wh- word) are in fact never chosen at all. The greatest difficulty is presented not by word order but by morphological confusion (2b, 2d), followed by the cases of omission of the auxiliary.

As can be expected from the overall results of the test, the indices of category difficulty tend to decrease from Test 1 to 2 to 3, and especially initial difficulty indices tend to be considerably lower for Group B than for Group A. It is, however, especially in Group A that some of the distractors become dramatically less effective after specific difficulties have been specifically

addressed by the teaching program: e.g. the singular/plural confusion (2b) falls from a 48% to a 3% effective distractor after teaching Yes/No Questions (Test 1 and Test 2), and various other morphological confusions (2d) drop from a 25% to a 4% "effectiveness" after presentation of the program (Test 1 to Test 3). These changes in the effectiveness of certain distractor types justify two comments: (1) The effect of the teaching program is most pronounced in the older but initially less advanced group, a fact that is worth commenting on because the use of traditional teaching methods usually demonstrated greater progress and more rapid advancement with groups that have initially the smaller English language deficit. (2) The very pronounced decrease in some program related difficulty categories (rather than an even decrease in all categor: · make it reasonable to assume that the gains made in Test 2 and Test 3 can not be related to "Test Learning" or "Hawthorne effects," since the latter should lower errors across the board in all error categories.

The difficulty of Error Categories as revealed by Part II of the test is reported on Table 8. Because Part II of the test showed no variation from Test 1 to 2 to 3, the table reports only total

Table 8. Difficulty of Error Categories,* Part 2 of the Tests

Part II of Tests			
Category	Group A	Group B	Total
1a	0	0	0
1b	0	0	0
1c	1	1	1
1d	0	0	0
1e	2	6	8
1f	0	0	0
2a	23	11	34
2b	10	7	17
2c	30	4	4
2d	46	31	77
3	0	0	0
4	0	0	0
5a	6	1	7
5b1	7	9	16
5b2	1	6	7
6	4	5	9

* Total number of errors committed in each category

frequency for each category. As Part II involves actual production, raw numbers of errors could not be adjusted for opportunities, since in production the opportunity for committing specific error types is not readily predictable. In examining the data on Table 7 one must also keep in mind that the figures for Group A and Group B are not exactly comparable since Group B (N=8/9) is slightly larger than Group B (7/8).

Although Group B has one more student than Group A, Group B makes typically fewer errors than Group A. The overall pattern of error difficulty and frequency, however, is very much like the one revealed in Part I of the test. The wrong embeddings, misplacement of Wh-word, and other word order errors (categories la, b, c, d, e) are practically absent. The most frequent errors are morphological confusions effecting tense (2a), number (2b), or other endings like the confusion between simple verb forms and forms ending in *-s, -ing, -ed* (2d). Omission of the auxiliary (5a, b), shown to be a real problem in the choice of distractors in Part I of the test, is again a rather important source of error in actual production.

Summary

In brief, the evaluation and testing undertaken may be summarized as follows:

1. Comparison of pre- and post-tests showed that the use of the materials led to a significant improvement in the ability to recognize correct Wh-questions.

2. This improvement was more pronounced and more dramatic with the older group of students who had initially the lower ability to recognize correct structures (and who were in general less proficient in English than the younger students involved in the evaluation).

3. The presentation of the Wh-question materials had no effect on lowering the number of errors committed in the actual production of Wh- questions, perhaps because a much more intensive and extended treatment is needed to bring about change in production of already acquired fossilized errors.

4. The most frequent and persistent errors committed by the students do not concern word order, but the confusion of morphological endings, and to some extent omission of auxiliaries. The treatment had considerable success in affecting the recognition of these error types but was not successful in reducing their incidence in production.

Reporting and Dissemination

Submission of *The Question Game* for Publication

Because of the demonstrated need of the Deaf to overcome the barriers of communicating in English, because significant numbers of deaf students need specialized educational material in order to develop competency in English syntactic skills, and to ensure that TECSD is used by the population for whom it is intended (rather than become "fugitive material" that is worthwhile but difficult to find), we fulfilled our proposed plan and offered the first option to publish *The Question Game* to Dormac, Inc., a leader in the field of printed material and computer-based instruction for deaf students. Hartley Courseware, a leader in the publication of CAI for special needs, ESL, and LEP populations, has also expressed a strong interest in our materials.

AERA Presentation and Publication: April, 1990, Boston, Massachusetts

At the 1990 AERA Annual Conference, the project director presented a paper, "A Computer Approach to Teaching English Syntax to Deaf Students." The paper discusses the results of a previous study, the *Yes-No Game II,* in which gains in syntax knowledge were made by subjects receiving the CAI-Syntax intervention. Appendix 1 includes the paper, which has been published by ERIC.

Informal Dissemination — 1989 - 1991

To make the TECSD materials and techniques available to the deaf students for whom they would be most useful, we have donated copies of the *Question Game* to the school sites who have generously provided their time, staff, and students to make the TECSD project successful.

To inform educators of the research potential of state-of-the-art CAI to improve English language acquisition and usage, the project director has accepted opportunities to present her research at four schools with programs for the deaf; as a result of her presentations, all four schools volunteered to participate in the TECSD Project. To develop deaf awareness in those less knowledgeable of the disability, Ms. Fogel has presented the research that she is conducting to such groups as Apple Computers, who agreed to loan Macintosh computers to the California School for the Deaf to facilitate the research process of TECSD.

Final Report to OSEP: June, 1991

The Final Report has been prepared for submission to the Office of Special Education Programs of the Department of Education. The results of the testing and treatment of highly visual CAI specifically designed for the Deaf are presented in relation to the project objectives of the TECSD Project. The report of the study presents findings first, followed by the methodological implications in utilizing linguistically controlled, highly visual CAI to teach difficult aspects of English syntax to the Deaf.

Submission of Summary Paper to AERA — Summer, 1991.

Currently, a summary paper, "Using the Macintosh to Teach Questions to Deaf Students," is being prepared for submission for presentation at the April, 1992 AERA Annual Conference. The paper discusses the results of the most recent intervention, the *Question Game*, in which gains in syntax knowledge were made by subjects receiving the CAI-Syntax intervention.

Statement of Accomplishments

At the end of the TECSD Project, we have accomplished a significant amount of important work:

- Updated a review of the literature in several fields related to the project: English language instruction for deaf and second language students, instructional design for computer assisted language learning, and linguistic studies of ASL and other communication modes of the Deaf.

- Built an expert Advisory Panel for consultation regarding the development of highly visual CAI material to teach English syntax to deaf students.

- Designed assessment instruments to be used in our experiments and by others in the field: three forms of the *Test of WH Questions* with the BE verb and with the auxiliaries DOES, DO, and DID.

- Developed the instructional material for *The Question Game*, CAI syntax material designed specifically for deaf students: the *Yes-No Game* (composed of seven lessons) and the *WH-Game* (composed of 10 lessons — 3 *Who*, 2 *When*, 3 *Where*, and 3 *What*).

- Conducted an intervention, the *Question Game*, with both elementary and junior high students, to determine whether linguistically controlled, highly visual software will enable deaf students to learn English syntactic structures (Wh-questions) with which they have experienced difficulty.

- Presented and published the results of a CAI study designed specifically for deaf students: "A Computer Approach to Teaching English Syntax to Deaf Students. Prepared a summary paper for submission to AERA: "Using the Macintosh to Teach Questions to Deaf Students."

- Distributed copies of the *Question Game* to participating sites, and submitted the *Question Game* to a commercial publisher, to ensure that the program is available to those for whom it was specifically designed.

Statement of Project Findings and Conclusions

The TECSD project, which dealt with the application of computer-based instruction to the teaching of English syntax to deaf students, attempted to determine whether highly visual techniques associated with ASL could be effectively utilized in computer-assisted syntax instruction designed specifically for elementary and junior high students. The experiment dealt with the effectiveness of computer assisted instruction for the Deaf in the area of formation of questions in English. The *Question Game* study was carried out in two stages: the first dealing with a limited exposure to the revised and refined version of the *Yes-No Game*, and the *WH-Game* dealing with questions involving *who, when, where,* and *what.* The experiment utilized specifically produced CAI material (*The Question Game)*, specifically produced tests, and error analysis of materials produced by students in the test situation. The treatment material that was devised made optimal use of ASL visualization techniques and simultaneity of expression — made possible by the use of the Macintosh computer. The tests consisted of two parts: Part I involved recognition of correct grammatical structures in a multiple choice format, and Part II required cued production of specific questions.

The experiment used a simple pre- post design. Analysis of the test scores showed that as a result of the CAI intervention, both Groups A and B made significant gains in Part I of the test, demonstrating the students' improvement in recognizing correct Wh-questions. In Part II the intervention had no demonstrable effect on the gains. In an earlier study with easier linguistic structures, students demonstrated statistically significant gains in actual language production (Fogel, 1989), and in a later study with more difficult structures, students showed a trend toward improvement in Part II (Fogel, 1990) With the significantly more difficult wh-question structures, a much more intensive and extended treatment may be needed to bring about change in production of already acquired fossilized errors.

An error analysis revealed that the most frequent and persistent errors committed by students concern the confusion of morphological endings, and to some extent the omission of auxiliaries. With no counterparts in ASL for auxiliaries or morphological endings, such as past tense markers attached to the verb, the persistent difficulties of the Deaf with these linguistic elements is understandable.

The intervention with the *Question Game* materials, originally designed for high school students and revised for elementary/junior high students, demonstrated statistically significant improvement with the younger populations. Interestingly, the older group, who had initially the lower ability to recognize correct structures, demonstrated a more pronounced and dramatic improvement than the younger group. Therefore, these CAI-syntax materials can be considered effective as both a primary teaching vehicle with younger students as they are as a remediation tool with older students. Although both the elementary and junior high students enjoyed working with

the Question Game, the younger students students were more enthusiastic and wanted to continue ad infinitum.

Effecting a change in language behavior that has become ingrained is a difficult, complex, and time consuming task. As evidenced by the documented results of our intervention, however, it appears that our CAI approach has substantial potential for accelerating the acquisition of English syntactic knowledge by deaf students.

Although our instructional intervention focused only on question formation, the effectiveness of this approach suggests the desirability of building a complete CAI-syntax curriculum based on visualization techniques as linguistic bridges from ASL to English syntactic structures. Visualization and simultaneity of expression in well designed CAI may be particularly important to basic concepts in the education of the Deaf; these aspects can build on certain strengths of the Deaf that are not utilized in standard teaching materials — those that are visual and spatial like ASL, rather than primarily linear and sequential like English. As a result, the difficulty of making grammatically correct judgements (as evaluated on Part I of the tests we administered), and the distinctive, ungrammatical deaf syntactic structures that have persisted in spite of years of schooling (as studied in Part II), may be ameliorated. Programs such as *The Question Game* may enable deaf students to proceed through three phases of language learning with more facility: (1) recognition (correctly judging grammaticality), (2) learning rules for production in a test situation, and (3) acquisition of generative rules (evidenced by spontaneous, correct use in real life communication). The results of *The Question Game* indicate a potential breakthrough in the heretofore intractable problems of deaf students to master English syntactic structures.

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APPENDIX 1

"A Computer Approach to Teaching English Syntax to Deaf Students"

Paper presented at the 1990 Annual AERA Meeting in Boston and published was subsequently in ERIC

A Computer Approach to Teaching English Syntax to Deaf Students

Paper Presented

at the Annual Meeting of the

American Educational Research Association

Boston

April, 1990

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Abstract

The formidable difficulties that deaf students experience in learning English are reflected in the large number of functionally illiterate deaf adults. To date, instructional methods have not effectively developed the ability of the Deaf to read and write English sufficiently. As a result, the majority of deaf adults remain undereducated, underemployed, and limited in their ability to participate fully in our society. Building on the visual orientation of the Deaf, and employing such American Sign Language (ASL) techniques as visualization and directionality, we designed a computer-based method of communicating syntactic knowledge to deaf students.

Yes-No II, the subject of this paper, is the second study in a series of research interventions using computer-based instructional treatments presented as educational games. To achieve the visual effects essential to our instructional approach, we used the high resolution graphics capability of the Macintosh; textual and graphic corrective feedback, displayed on the computer screen, respond specifically to each error that students make in building English questions, and enable them to correct their misunderstandings. With accompanying pictures to aid comprehension, and with multiple opportunities to practice and to receive immediate visual feedback, the experiment demonstrated that an instructional foundation and methodology can be provided that will help deaf students overcome their difficulties in building yes-no questions in English.

To assess treatment effects, reliable tests were constructed to measure the efficiency of the *Yes-No* computer-based materials in teaching specific English syntax skills. These tests consisted of two parts: Part I, in a multiple choice format, measured the students' recognition of correct grammatical structures, and Part II elicited actual sentence production. Developed in several forms, the tests were administered in a pre-post test evaluation. Especially Part I of these tests showed rapid improvement in areas of syntax in which progress with conventional materials in the classroom is at best extremely slow.

Introduction

An effective, comprehensive program of instruction for deaf students in basic English reading and writing skills has yet to be developed. Only 10% of the best 18 year-olds read at or above the eighth grade level, and the average deaf adult reaches only a fourth grade reading level (Quigley, 1984). As a result, large numbers of deaf adults remain functionally illiterate.

Although the Deaf have been disadvantaged by their handicap, developments in research and practice suggest a promising future. Recent theory and research in linguistics have extended to studies of language and communication of the Deaf. The pioneering work of William Stokoe (1960) followed by Bellugi (1972), Newport (1977), Siple (1978), and Lane and Grojean (1980), indicated that American Sign Language (ASL) was indeed a "natural" language. Where English is a natural aural-oral[1] language, ASL is a natural visual-gestural[2] language that has evolved to meet the specific communication needs of the Deaf. Using highly visual information processing and storage techniques, the Deaf acquire linguistic structures with facility in ASL; yet, they experience great difficulty learning comparable structures in aural-oral languages. This paper reports on the efectiveness of an intervention which used techniques of computer-based instruction that were grounded in a methodology of visual information processing to facilitate language acquisition by the Deaf.

Theoretical Framework

In order to design an effective instructional program, we needed to understand why the Deaf have difficulty understanding English, particularly syntax. First, we turned to the research in cognitive psychology and psycholinguistics which demonstrated the many ways in which the Deaf rely on visual coding rather than auditory/speech coding (Conrad, 1973; Lichtenstein, 1983). This unique processing style, which may render traditional instruction inaccessible, suggests that presentations that are visually oriented might be especially effective. Pointed toward highly visual techniques, we realized that we could take advantage of the possibilities of visual presentations on the computer to help deaf students learn those aspects of English syntax with which they traditionally experience difficulty in English but comprehend with ease in ASL (Fogel, 1986 &1988). We found strong support for our endeavor to apply technological innovations to the problems of linguistic processing of deaf children in the well known document, Toward Equality: Education of the Deaf, (Commission, 1988).

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[1] Aural-oral indicates that language is received auditorally and transmitted through speech.
[2] Visual-gestural indicates that language is received visually and transmitted in space through signs and gestures.

With the availability of new computer technology for instruction, many of the obstacles to effective English syntax instruction for the Deaf may be removed. The potential of computers to build highly visually-oriented materials can capitalize upon the visual-gestural grammar inherent in ASL and expose deaf students to the rich English language environment that their hearing peers experience daily. Hearing children enter school with a fairly complete knowledge of the syntax and lexicon of the English language; they learn to map the written word onto what they know "sounds right." In contrast, deaf students who have never heard English are expected to replicate the lexicon and syntax; they must learn how to read and write an auditorally based language without access to the spoken word.

Microcomputer-based language programs, however, can offer a way to build upon the prior language-related, visual knowledge that the Deaf acquire in learning sign language. Even if the learners are not competent in sign language, we can assume a predisposition to rely on a visual modality in their communication. Most English instruction focuses on the linear sequencing of the language; it does not demonstrate linguistic relationships by movement in space. However, computer-assisted instruction (CAI) can add the ASL dimensions of position and motion in space to enhance English language learning; as a result, educational software can offer hearing-impaired students more rewarding opportunities for interactive language experience than they usually encounter. Utilizing visualization,[3] directionality,[4] and simultaneity of expression,[5] which the Deaf use so effectively in ASL communication, CAI can employ graphics, windows, and reverse video to highlight and emphasize instructional points and corrective feedback. Through CAI designed specifically for the hearing-impaired, students can be motivated to interact with an instructional environment in which the syntax, vocabulary, and figurative language are linguistically controlled and incrementally graduated in difficulty. English language acquisition and usage can proceed at the learner's own pace, but more rapidly than previously experienced by deaf students.

Drawing on successful language research on the education of deaf persons (e.g., Iran-Nejad, 1981), we applied a Direct Instruction approach (Becker & Engelman, 1977). Although the term "direct instruction" is associated with a small set of educational researchers, there is some

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[3] Visualization — focusing on sight (e.g., using computer graphics and video effects) as the primary mode of communication to convey syntactic information.

[4] Directionality — modulations (e.g., of verbs) to indicate such grammatical relationships as subjects, objects, and locations.

[5] Simultaneity of expression — the co-occurence of grammatical or lexical information (e.g., aspects of time, as regularity, duration, repetition, tense).

consensus among a wide range of instructional psychologists on a core set of design principles which are fundamental to direct instruction. The learner should:

- have the prerequisite knowledge to use the instruction and to learn additional skills
- be motivated
- be guided through models which make clear when and how to apply new knowledge
- have ample opportunities to demonstrate their mastery of models in a context that makes errors likely, if the learners have not understood the new content well
- be able to benefit from corrective feedback

To test the effectiveness of an instructional intervention to teach English syntax skills to the Deaf, we (1) used the computer's special graphic capability to present concepts linked to the visual-gestural knowledge base of the Deaf, and (2) grounded the instructional design in a Direct Instruction approach.

Preceding Work

This paper details one of a series of studies to determine whether highly visual techniques associated with ASL could be effectively used in computer-assisted English syntax instruction designed specifically for Deaf students. An introductory phase of the experiment, *Choosing AVMs* (Advanced Visual Markers), consisted of an inquiry to determine which of several visual markers signifying interrogation and negation would be considered most effective as syntax clues by different types of hearing-impaired populations. The results of that study indicated that students selected AVM icons closely related to their primary mode of communication — ASL, SEE II, or Aural-oral English — leading us to conclude that different visual clues may be more effective for hearing-impaired groups with different language backgrounds (Fogel, 1988).

The first experiment dealt with the effectiveness of computer-assisted remedial instruction for the Deaf in the formation of yes-no questions in English. The study dealt with questions involving BE as a main and auxiliary verb. The experiment utilized specifically produced CAI material for treatment and control groups in the form of computer games, specifically produced tests, and error analysis of materials produced by students in the test situation. The treatment material that was devised made use of ASL visualization techniques and simultaneity of expression — made possible by the use of the Macintosh computer.

This experiment, the *Yes-No Game I*, used a simple pre- post-test design and included, in addition to the CAI treatment, the use of a distinct Advanced Visual Marker (icon), and the students' reading comprehension scores as independent variables in the evaluation of the experiment. The results showed clearly that the CAI treatment contributed significantly to gains from pre- to post test; the use of the AVM icon, however, did not contribute significantly. Reading scores contributed significantly only in Part II of the test, the language production section that depends upon the comprehension of stimulus paragraphs. The game format and other design features utilized in the first study were retained in the research reported in this article.

Development of Treatment Materials

We tested learners of different grades (7-12) to determine (1) the structures with which secondary students experienced difficulty, and (2) the age at which they mastered those grammatical patterns. Using Quigley's Test of Syntactic Abilities (TSA) as a model, we developed a 100-item Diagnostic Test of Interrogative and Negative Patterns, which we administered to 72 students at a residential school for the Deaf. All test items used the multiple choice method. The first 70 items required the recognition of correct English grammaticality; the last 30 asked the student to identify a sentence which follows from, or is at least semantically compatible with, a situation briefly described in the item stem. By analyzing the frequency of mistakes on the Diagnostic Test, and considering the linguistic problems underlying these mistakes, linguists identified appropriate targets for syntax instruction and remediation. The target chosen for this study was the use of the auxiliaries DO, DOES, and DID. In addition, the distribution of error frequencies and types by grade levels helped to define the population that had sufficient prerequisite English syntactic knowledge to be able to benefit from the intervention, but who lacked the ability to correctly build the structure to be taught; the test analysis also aided us in constructing subsequent tests which were used to form matched treatment/control groups.

The teaching materials we developed took the form of a computer game, the *Yes-No Game*, which employed a variety of visualization techniques to maximize learning for the Deaf. The computer materials for each study included:

- Interactive instructions on how to use the Macintosh for the *Yes-No Game*

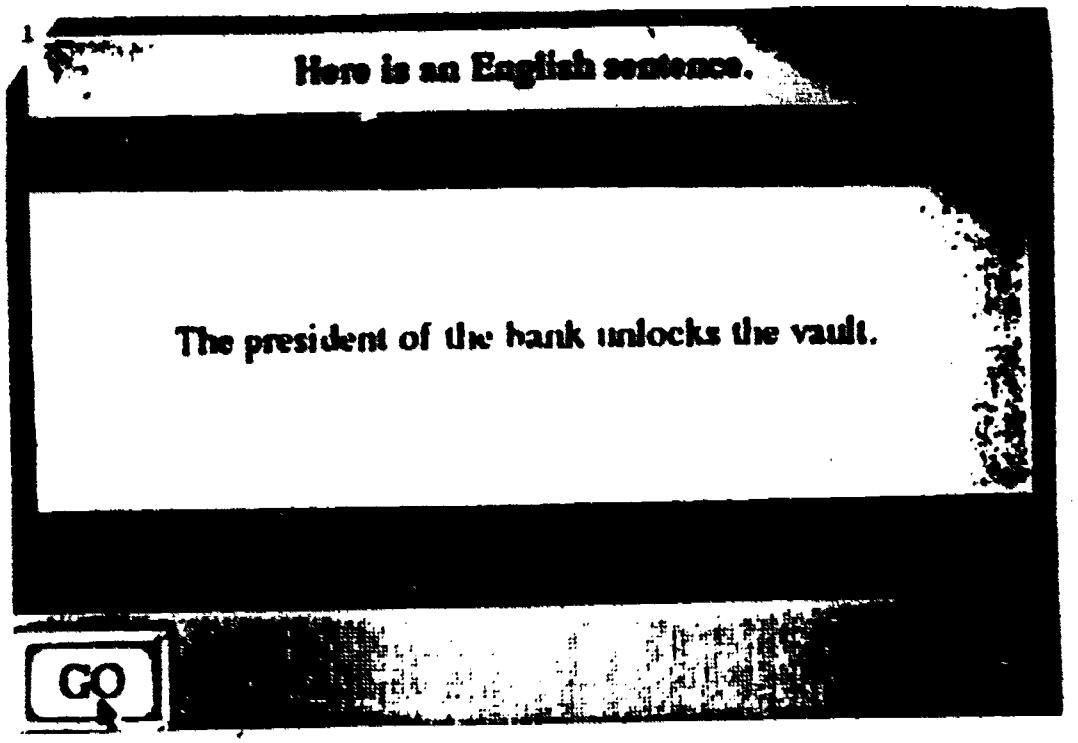
- Animated screens illustrating the transformation of a declarative sentence to a yes-no question
- Practice sessions in which the students:

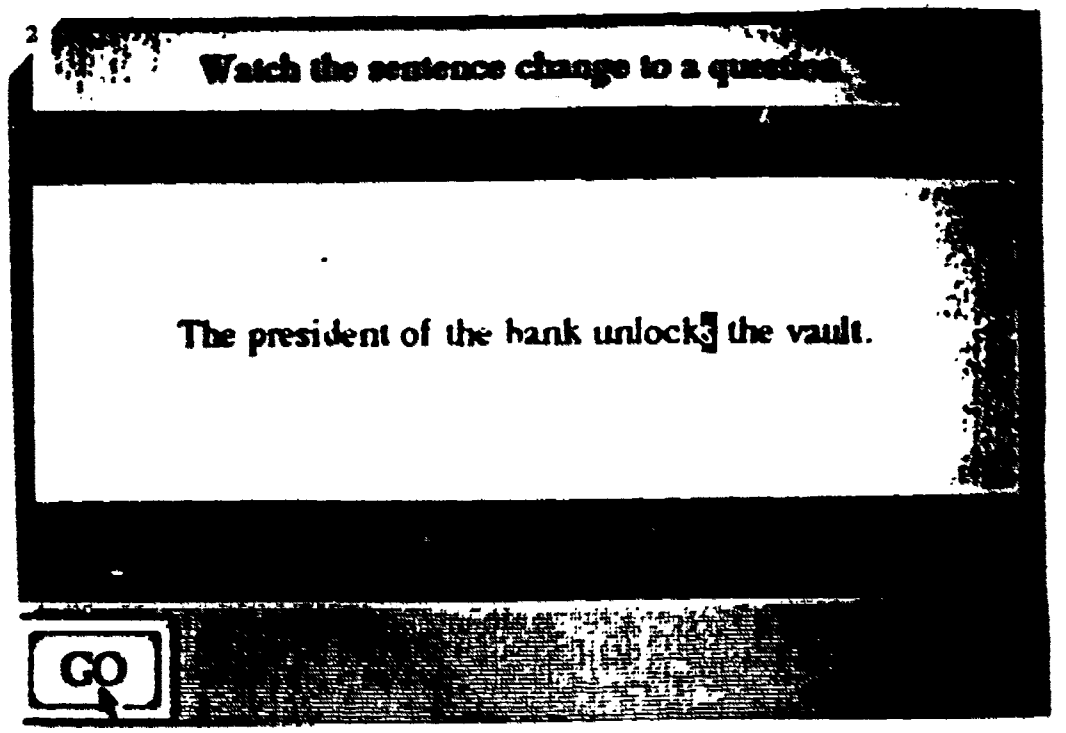
    1. Create a sentence-picture
    2. Build a yes-no question
    3. Receive visual and written corrective feedback for each error
    4. Review earlier lessons and transformations if in need of remediation, or
    5. Progress to sentences of increasing length and difficulty

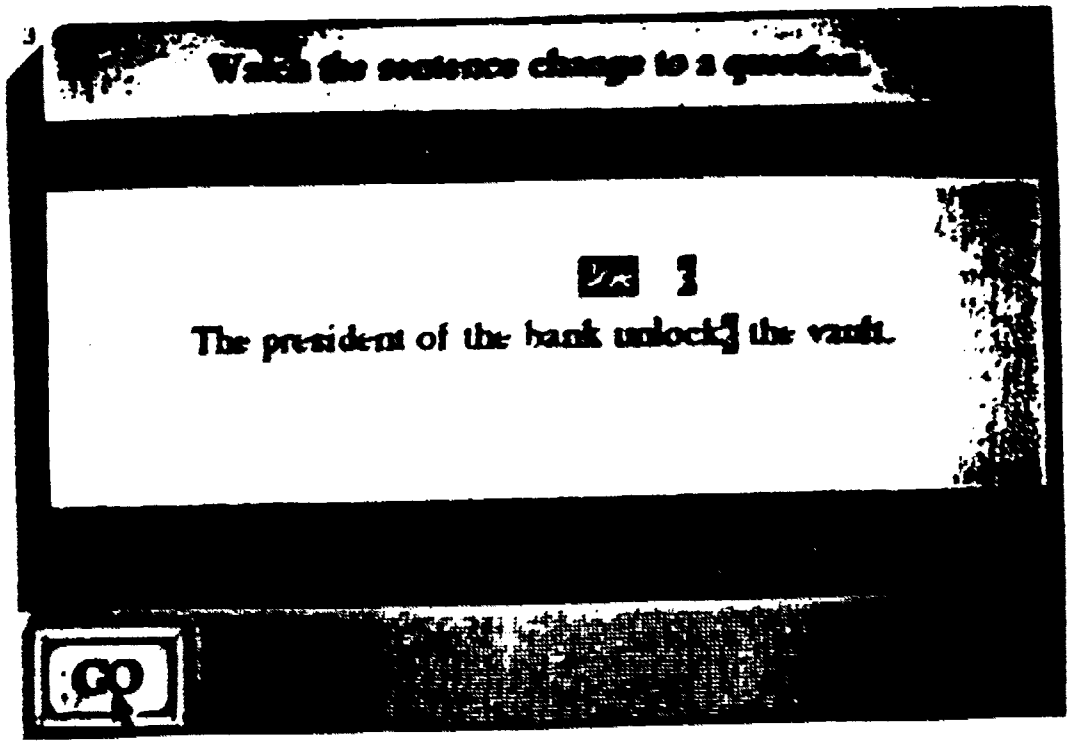
To enhance the visualization of the interactive Macintosh instructions, we incorporated VideoWorks, a computer program which simulates motion pictures. To help those students who were unfamiliar with the Macintosh and had experienced difficulty manipulating the mouse, a VideoWorks animated drawing of the moving, lifting, and repositioning of the mouse explained visually how to use the mouse.

To develop excellent graphically oriented material in a relatively short period of time, HyperCard had been utilized in a previous study involving the BE verb and icons as a visualization technique. The performance of *Yes-No II*, the study reported here, was improved by the use of MacApp, an object-oriented programming language that efficiently implements the standard features of most Macintosh applications. Because the AVM icons were not associated with pre-post-test gains in the previous study, they were omitted in the practice sections of this study. However, we incorporated an AVM icon in the initial transformation screens to indicate that a sentence had been transformed to a question; the AVM question icon floated across the question to replicate the ASL facial expression that is present as a linguistic marker during the signing of a yes-no question.

To guide learners through visual syntactic models, animated graphics picturing the transformation of sentences to questions preceded multiple practice opportunities for each syntactic structure taught. By visually depicting the transformation of a declarative sentence to a question, as shown in Figures 1 and 2, the students were provided with an alternative to relying exclusively on printed text for reading comprehension. For example, after a declarative sentence appears in the *Yes-No II Game* (The president of the bank unlocks the vault), the "s" in "unlocks" duplicates itself in the line above; "doe" appears and meets the "s" to form "does." Next, "unlock" in the







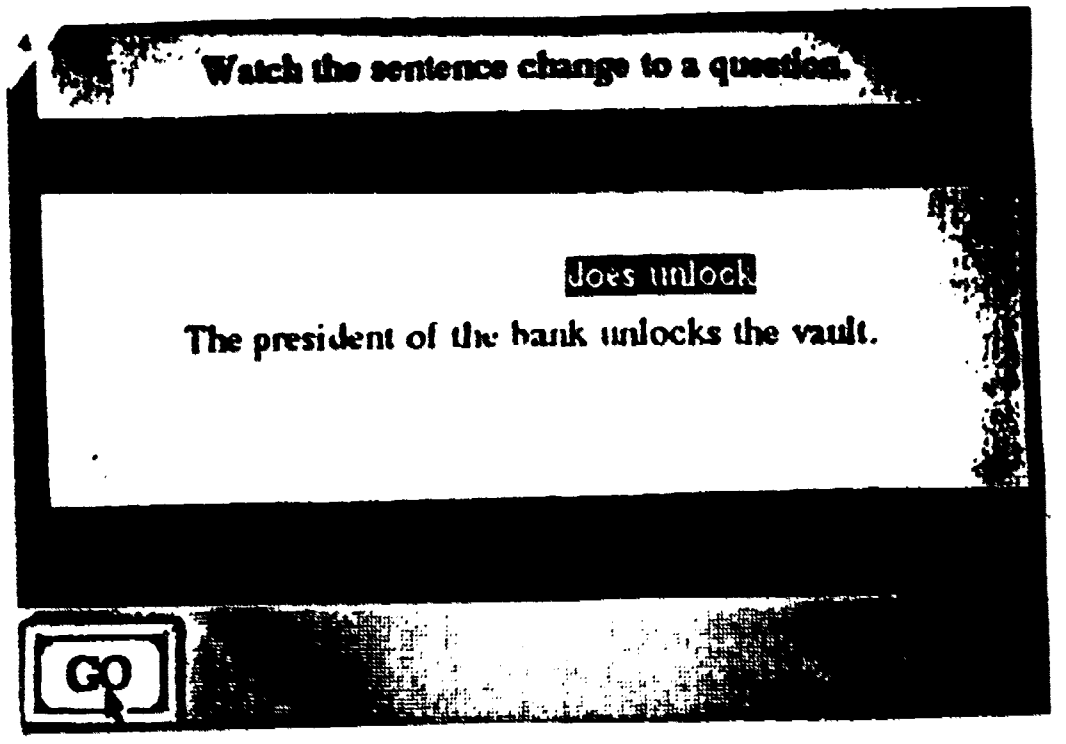
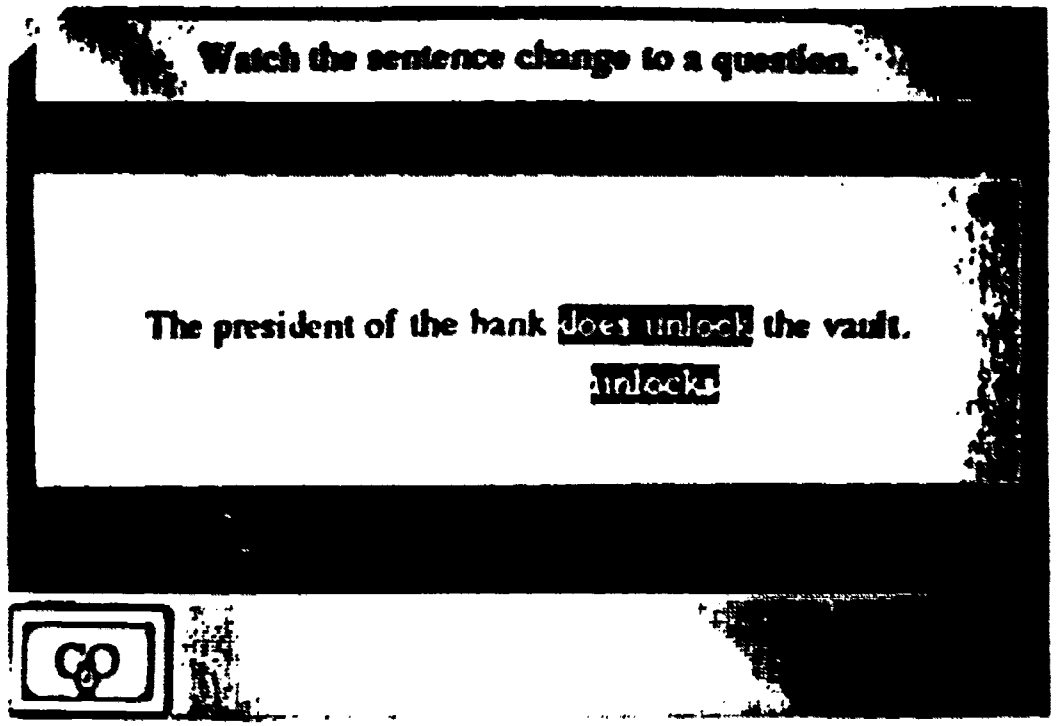
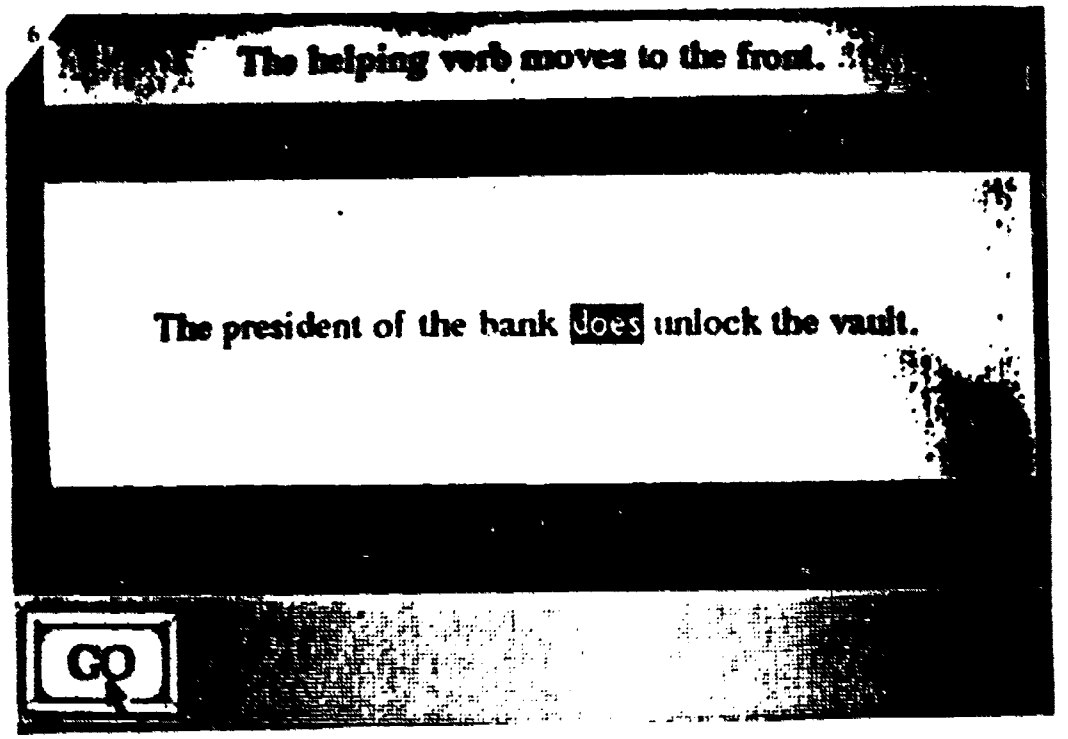
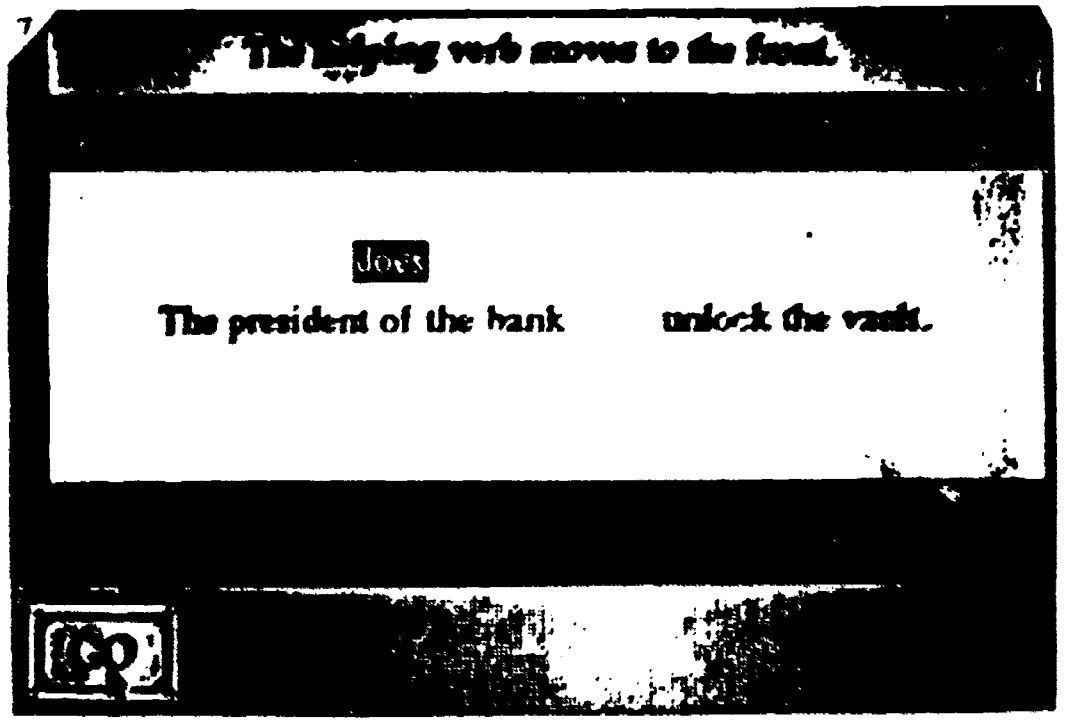


Figure 1. Transformation of a Declarative Sentence to a Question — *Yes-No II*







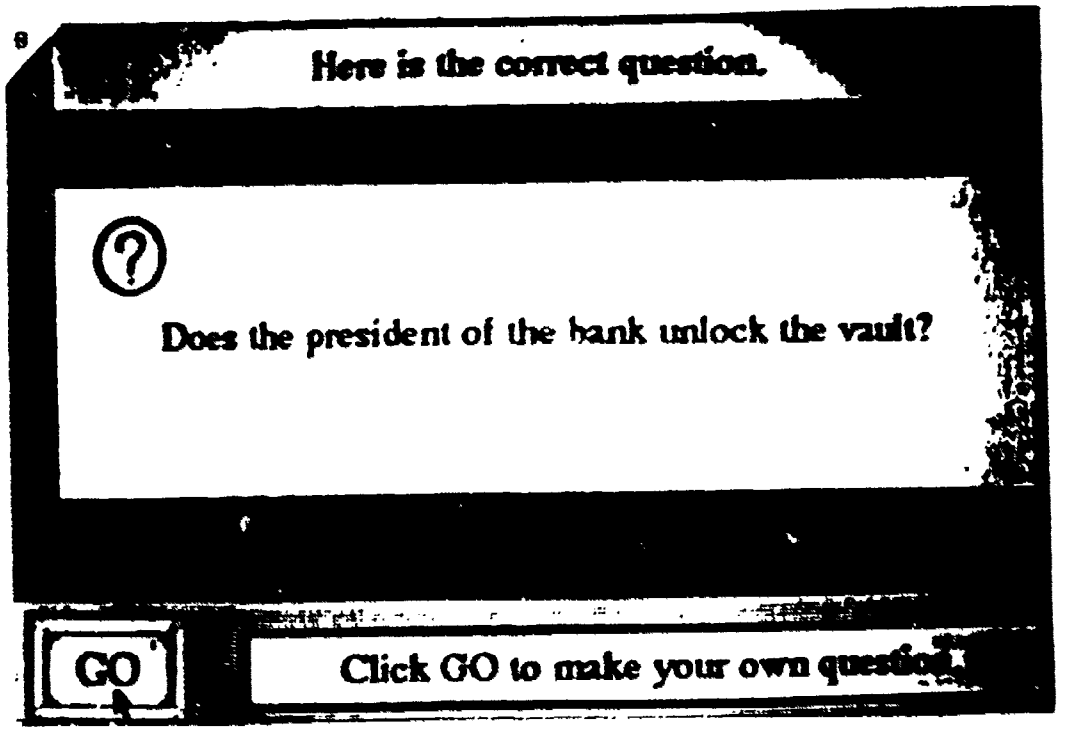
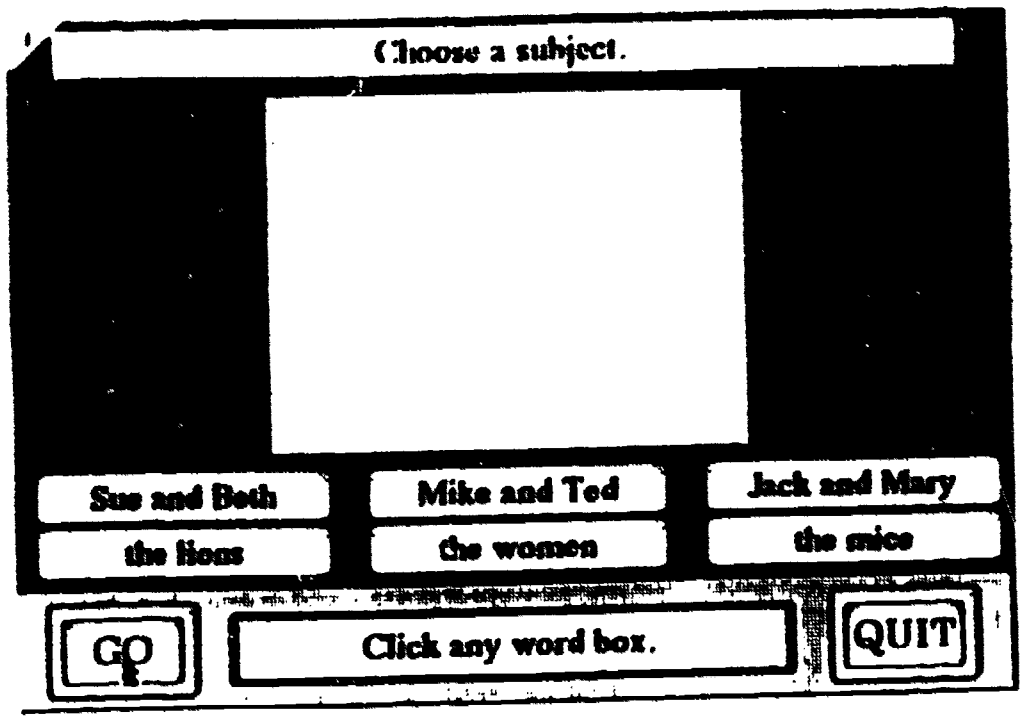


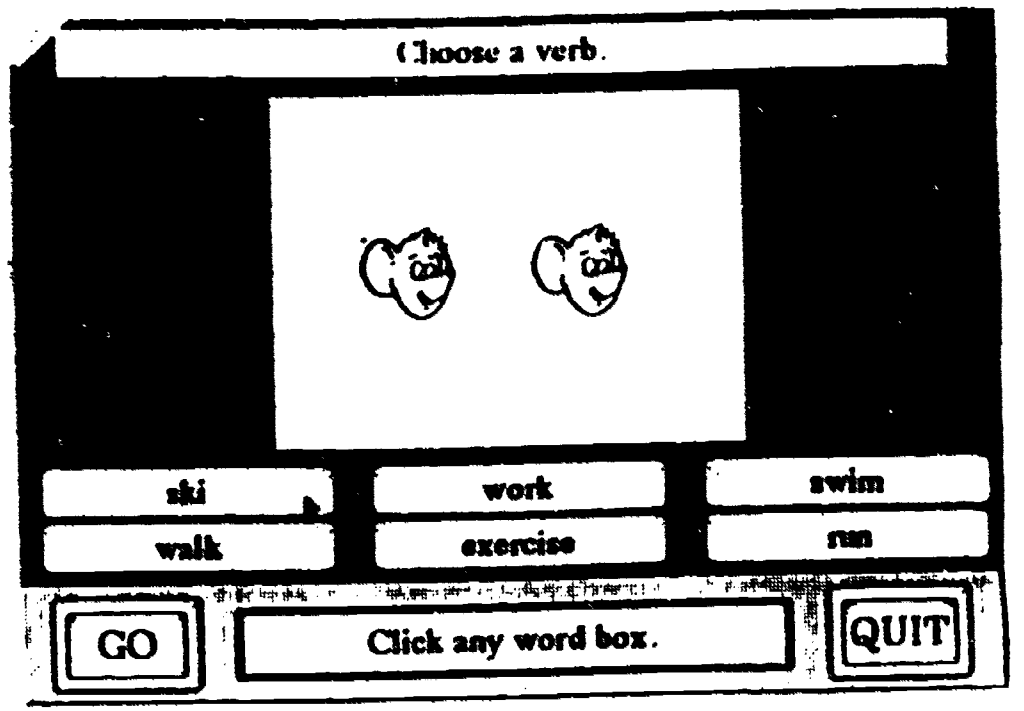
Figure 2. Transformation of a Declarative Sentence to a Question — *Yes-No II*

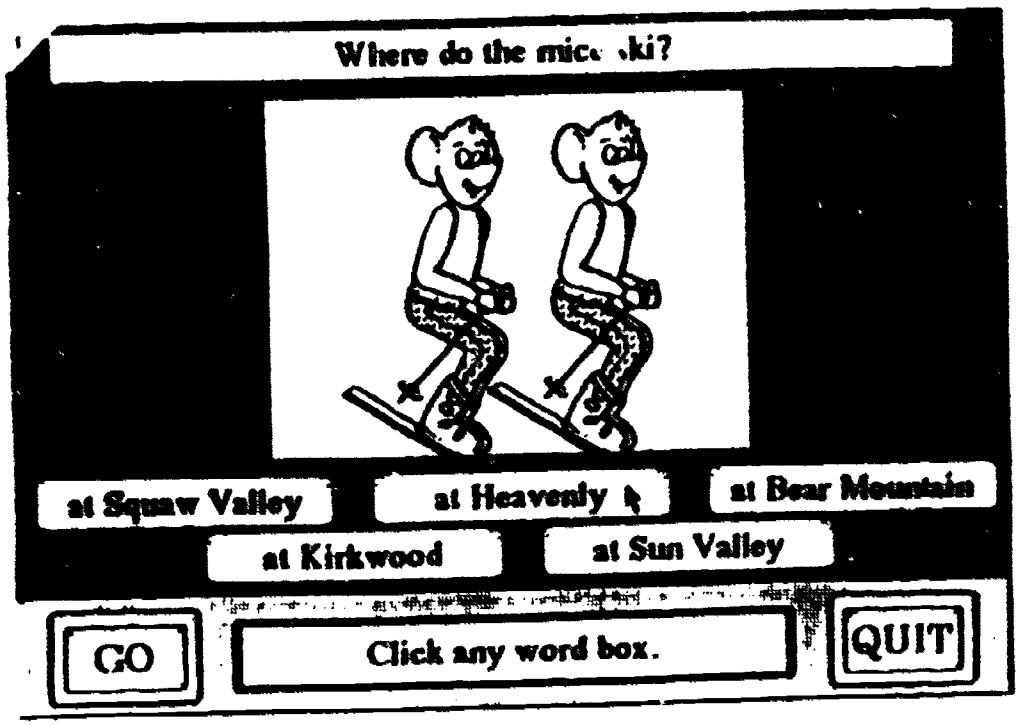
sentence duplicates itself in the line above; "does unlock" in the line above flashes alternately with "unlocks" in the sentence to visually state that both expressions are the same. Slowly, "does unlock" movesdown into the sentence to replace "unlocks," which moves down and dissolves. In the new sentence (The president of the bank **does unlock** the vault), "does" flashes and moves to the line above; "does" travels left to the beginning of the sentence, where it drops into place. The empty space which held the auxiliary verb closes, the "d" in "does" is capitalized, and a question mark replaces a period at the end of the sentence (Does the president of the bank unlock the vault?). Such visual representations of language structures and transformations are an integral part of both the instructional modeling and the immediate, corrective feedback in the *Yes-No II Game*.

To capitalize on ASL's visualization and simultaneity of expression, computer graphics and animation are incorporated to enhance comprehension, clarify meaning, and maximize the transfer of relevant knowledge. In addition, to engage and motivate the learners, we involve them as active participants in their instruction. First, students are provided with multiple opportunities to build their own — often humorous — sentences, which are automatically illustrated by the program. As shown in Figure 3, "Creating a Sentence-Picture," a student chooses the subject "mice" from among six possibilities (which are randomly selected from a file of 20 possible subjects), and the heads of two mice appear in the picture box above the word choices. Next, if the student chooses the verb "ski" from among six randomly displayed verbs, the picture changes to display the mice skiing. Similarly, direct objects and adverbials of time and place are selected; as each word is picked, a visual counterpart is added to the picture to represent the sentence as it is built by the student.

After the sentence is completed and its picture displayed, the "Building a Question" screen invites the student to create an appropriate yes-no question for the picture. Figure 4 displays a sample screen containing a picture and a matrix of possible words and phrases from which students build their own questions. Unlike most CAI, the *Yes-No Game* does not limit learners to making simple choices among a set of "right answers." Rather, students were tested to identify common misunderstandings and errors in yes-no syntactic patterns; distractors that could result in the students' manifesting these misunderstandings were incorporated in the program, and effective corrective feedback that responded to individual students' errors was provided. For example, for a picture of Leo driving a truck every day, the randomly presented items could include a period, a question mark, and the following words: Leo, do, does, did, drive, drives, drove, a truck, and every day.







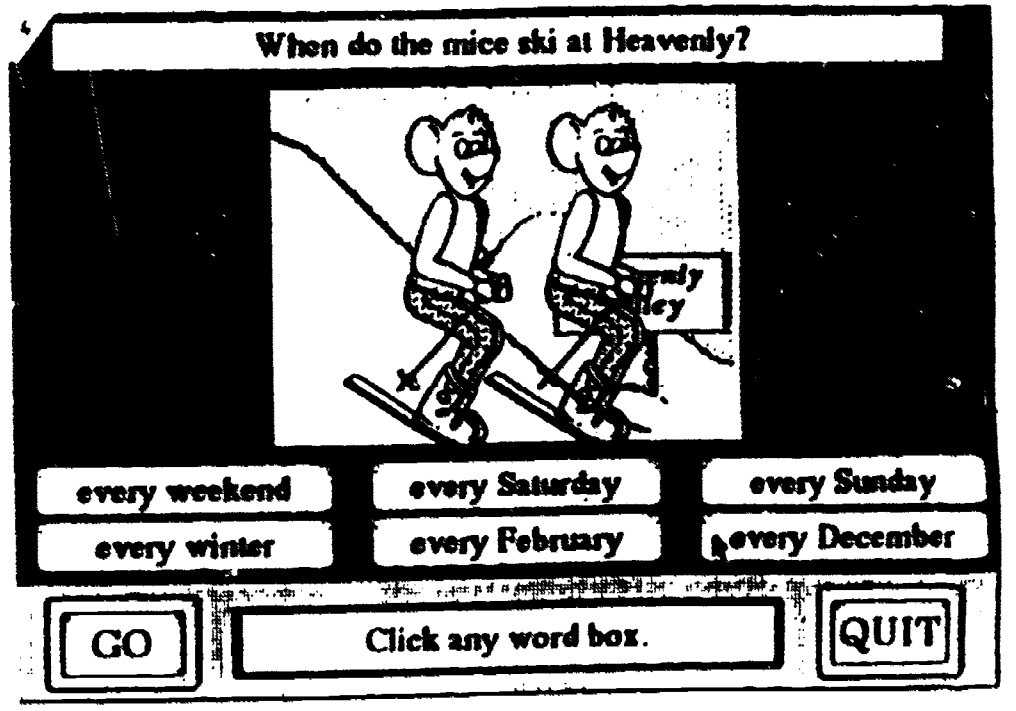


Figure 3. Creating a Sentence-Picture — *Yes-No II*

Multiple opportunities for initiating interactive practice are provided. Students have as many as 10 opportunities to build each question; for each attempt, learners benefit from detailed, corrective feedback for common errors (about 20 per structure). The feedback is designed to provide specific visual and written responses for each type of error. A first incorrect try results in a written and visual hint; a second incorrect attempt in the same error category provides more specific information, and the third supplies the correct answer with a textual and visual explanation. If the student cannot correct the mistake after several tries, the student's incorrect question is visually transformed to the correct syntactic pattern through animation. Figure 4 illustrates the use of brief, linguistically controlled messages that respond specifically to some of the likely misunderstandings that lead to students' common errors in yes-no questions: (1) omitted, incorrect, misplaced, or repeated auxiliary, (2) double marking the tense on both the auxiliary and main verb, and (3) incorrect word order. Of equal or greater importance is the visual feedback to incorrect questions that students build: the error is highlighted in the student's question while the correct possibilities are flashed slowly in the word matrix; a double tense marking is highlighted with underlining and an "X" over the incorrect suffix, and the correct place of the auxiliary in the question is indicated by a flashing arrow.

Provision to review structural modeling was built into the program for instances when the specific, corrective feedback was insufficient to correct misunderstandings; however, the [illegible] feedback proved so effective that none of the subjects ever triggered the more detailed modeling reviews. The success of the feedback can perhaps be attributed to its visualization — video "effects" such as flashing, highlighting, and reverse video, as well as such graphics as the pointing arrow to emphasize instructional points.

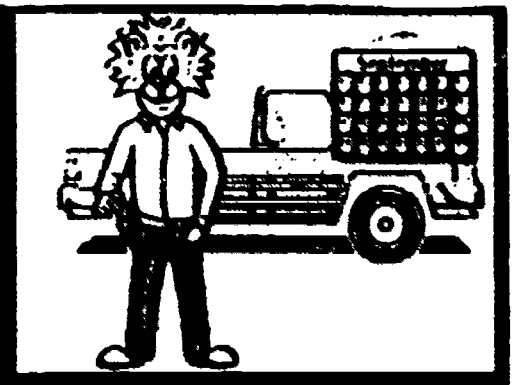
Subjects

To ensure the participation of a large number of high school subjects who had sufficient prerequisite English syntactic knowledge to benefit from the *Yes-No Game*, but who lacked the ability to form yes-no questions, we conducted the intervention at a residential school for the Deaf. After the principal and teachers screened out the learning disabled students because of their insufficient prerequisite syntactic knowledge, and the advanced students whose English language placement indicated that they had already mastered the treatment material, the Yes-No Screening/Pre-test was administered to 76 eighth, ninth, tenth, and eleventh grade students. The

1

Make a Question
Click words in the right order.
Click GO when you finish.

drive	?
does	drives
every day	does
Leo	a truck
.	

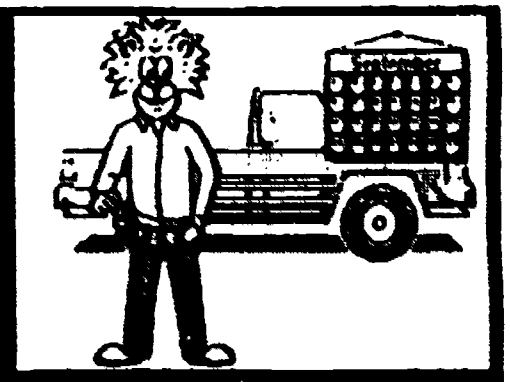


GO ERASE QUIT

2

Make a Question
Click words in the right order.
Click GO when you finish.

drive	?
does	drives
every day	does
Leo	a truck
.	



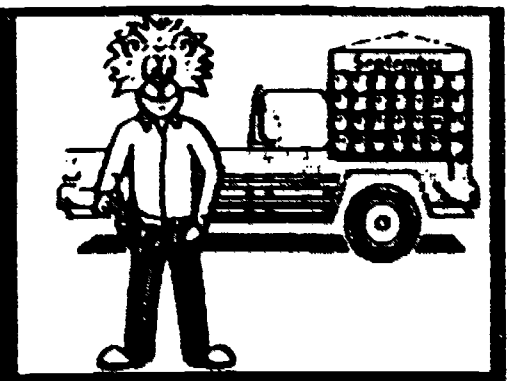
Begin your question with the helping verb, "does."
Click GO to try again.
Leo drives a truck every day?

GO ERASE QUIT

3

Make a Question
Click words in the right order.
Click GO when you finish.

drive	?
does	drives
every day	does
Leo	a truck
.	



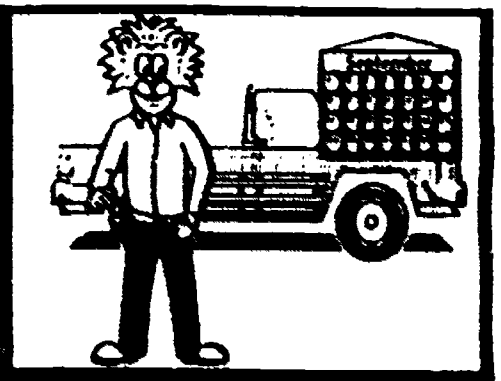
Put the helping verb at the beginning of the question.
Click GO to try again.
Leo does drive a truck every day?

GO ERASE QUIT

4

Make a Question
Click words in the right order.
Click GO when you finish.

drive	?
does	drives
every day	does
Leo	a truck
.	



Use the simple form of the verb, "drive."
Click GO to try again.
Does Leo drive a truck every day?

GO ERASE QUIT

Figure 4. Building a Question — *Yes-No II*

test was composed of two parts: Part I, which consisted of 25 items modeled on Quigley's TSA multiple choice format, measured the students' recognition of correct grammatical yes-no question structures; Part II elicited actual yes-no question production in response to a short paragraph stimulus. Students who scored above 85% or below 25 % were eliminated from the pool of possible subjects because they had demonstrated that they did not need the yes-no intervention or did not possess sufficient knowledge of English to be able to benefit from the treatment material. The subjects for the intervention were selected and matched on two criteria: their recent SAT-HI reading scores, and their performance on the Yes-No Screening/Pre-test. For each pair, one subject was randomly assigned to the treatment group and the other to the control group; the process resulted in two groups of 18 students with comparable syntactical knowledge of written English. The subsequent loss of subjects during the research process resulted in an eventual sample which consisted of 17 treatment and 15 control subjects, ages 14 to 18.

Data Collection

The *Yes-No II* Study was a two phase intervention, which tested the null hypotheses: CAI designed to teach English syntax to deaf high school students would have no effect on their syntactic knowledge. Figure 5.1 shows the schematic diagram of the experimental design. One week prior to the first phase, Test 1 of a two-part pencil and paper test was administered to both the treatment and control groups. Part I of the test was modeled on the diagnostic sub-tests for question formation of Quigley's TSA; composed of 25 multiple choice items, it required the recognition of correct English grammaticality. Part II consisted of 10 open-ended items for which students were asked to write an appropriate question in response to a stimulus of one to three short sentences. A question that could be interpreted as having been logically and meaningfully stimulated by the short paragraph, and that did not contain syntactic errors for which the subjects had received instruction, was accepted as a correct response. Part II involved active sentence construction and was therefore a more difficult task for the students.

As shown in Figure 5.1, the treatment group (A) completed the three lessons in the CAI-Syntax program in two to three class periods (90 to 135 minutes). To minimize and possibly control the impact of a possible Hawthorne effect, the control group (B) used an alternate computer program in an unrelated subject area for the same period of time. For both the treatment and control groups, students proceeded through the computer programs individually; each learner controlled the pace. Within one day after completion of the first phase of the CAI intervention, Test 2 was administered to both groups. Two weeks after the administration of Test 2, Group A

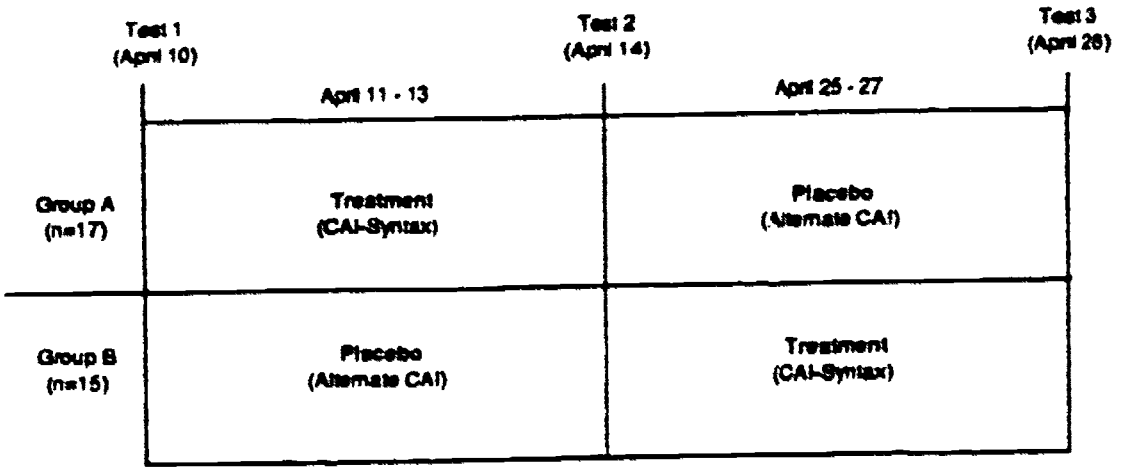


Figure 5.1 Schematic Diagram of the Experimental Design

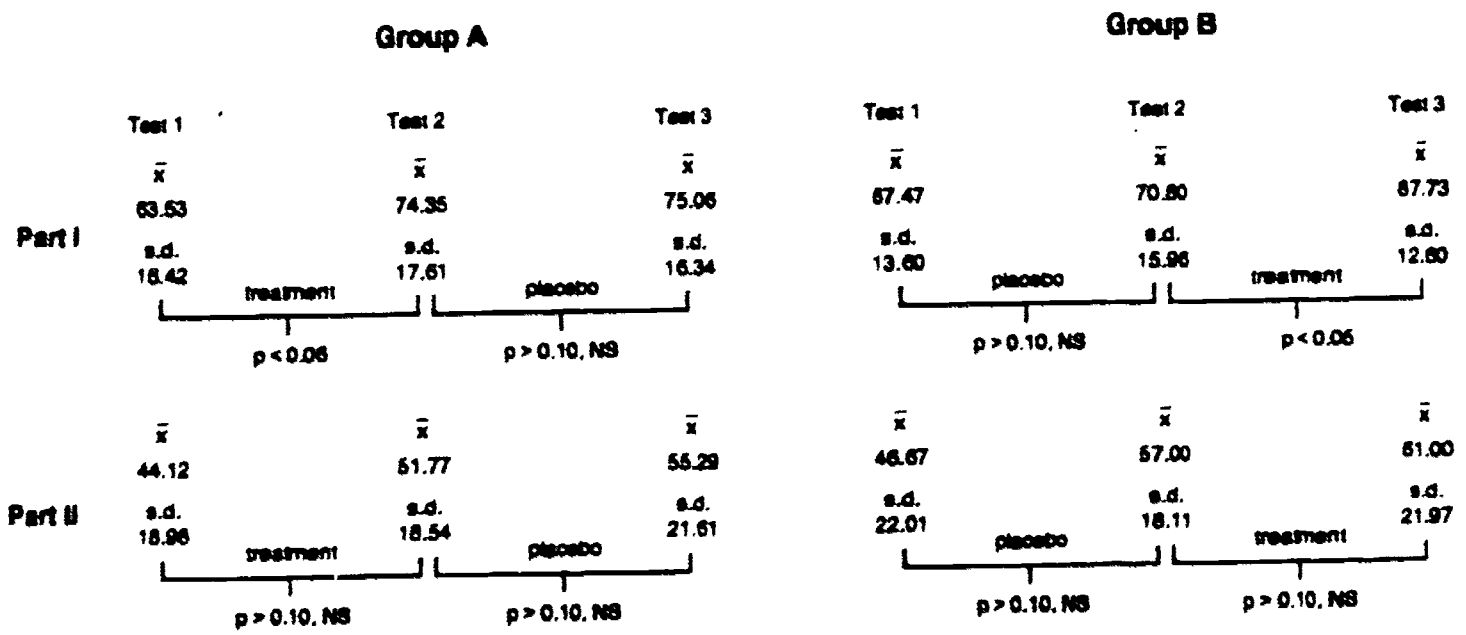


Figure 5.2 Comparison of Group Means of Test Scores (Significance levels determined by ANOVA "Least Significant Difference" test of paired contrasts)

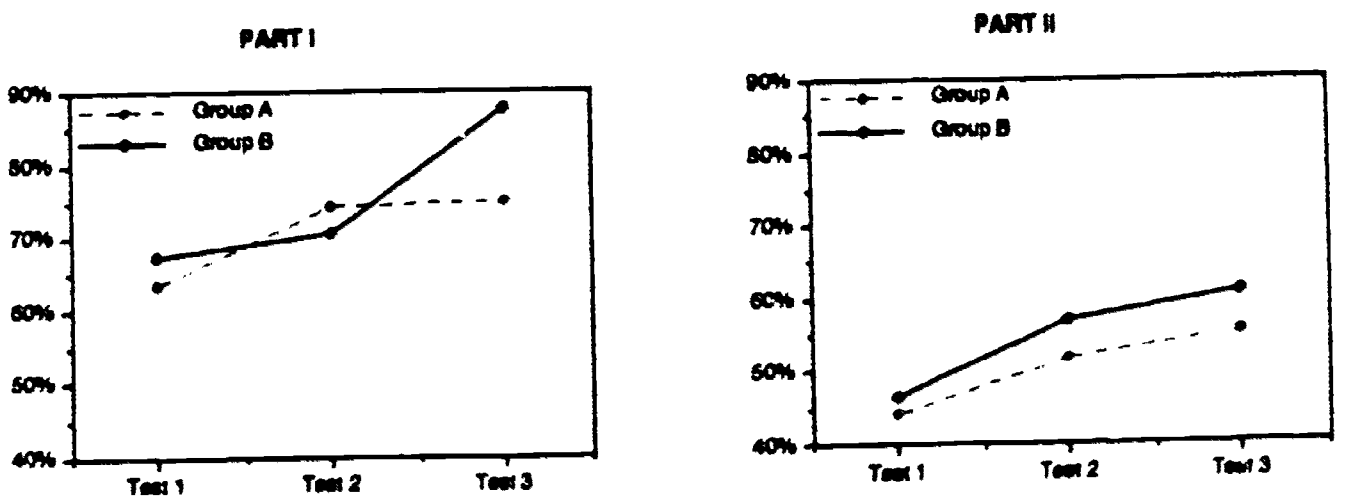


Figure 5.3 Effects of CAI Instruction and Alternate (Placebo) CAI

Figure 5. ***Yes-No II*** **Results**

used the alternate computer program, and Group B used the CAI-Syntax program. The next day, Test 3 was administered. The format, level, and administration of Test 1, 2, and 3 were comparable; the syntactic structures in each of the test items were identical, but the nouns and verbs were different. The internal consistency of the three tests were assessed using Cronbach's Alpha. The reliability coefficients were uniformly satisfactory for both parts of the tests: for Part I they were .76, .77, and .79; for Part II they were .73, .77, and .78.

Correlations between Parts I and II of each of the three test forms seem to indicate that, as expected, they test highly related, but not identical skills ($p<.05$). The parallelism of the different forms of the test being used is shown by the high correlations between them: for Part I the r's ranged from .54 to .59, and for Part II from .63 to .72. Further test development, including item analyses, is still necessary to improve the usefulness of these tests.

A record keeping module was integrated in the *Yes-No Game* to facilitate data collection, and to provide easy access to information of the students' performance while they interacted with the program. Continually updated "Records" of correct and incorrect responses enabled the research observers to check the subjects' progress during the intervention. Detailed "Histories" of every keystroke and response in the syntactic practice, as well as the time between each response, were designed to be converted to text files for later analysis of the pattern of the subjects' sequential responses.

Results

Part I - The Multiple Choice Section. As displayed in Figures 5.2 and 5.3, both phases of the intervention are associated with pre- post-test gains. As determined by Analysis of Variance (ANOVA) and paired contrasts using a "Least Significant Difference Test (LSD)," significant gains in syntax knowledge were made by each group receiving the CAI-Syntax treatment: the means for Group A rose from 63.53 in Test 1 to 74.35 in Test 2 ($p<.06$), and the means for Group B rose from 70.80 in Test 2 to 87.73 in Test 3 ($p<.05$). In comparison, the control group (L) demonstrated no significant gains with the alternate CAI from Test 1 to 2. Even when Group A was tested two weeks after the CAI-Syntax treatment, their Test 3 scores did not fall below the level of Test 2, suggesting that the improvements in syntactic knowledge were retained.

Although we presumed that we had matched pairs, in both the *Yes-No I* and *II* studies, Group B performed better than Group A in Parts I and II of all tests for both studies; however, the

differences were not statistically significant. After the studies were completed, the results from the students' new SAT-HI were released; they indicated that at the time of the experiments the students were no longer exactly matched on reading scores. With such a small sample, significant differences in only a few of the students' reading scores are sufficient to explain the better performance of Group B. Because in English language studies with this population there is a potential confounding effect of students' reading abilities, we decided to repeat the analyses in the previous section, but include an assessment of the interaction of reading ability with the intervention (i.e., students with high reading ability would benefit more from the CAI Syntax treatment than students with lower reading scores). The procedure we employed was Analysis of Covariance (ANCOVA). Results indicate no independent interaction effects for Part I. This finding is not surprising considering the nature of this part of the test, which requires only recognition of grammatical correctness, not reading comprehension of paragraph stimuli as in Part II.

Part II - The Language Production Section. Whereas Part I involves recognition of grammatical correctness, primarily in syntax, Part II is dependent upon the comprehension of the 10 stimulus paragraphs, i.e. the multiple tasks involved in reading, such as making inferences from context clues. To investigate the effects of CAI-Syntax intervention on language production , we again used ANOVA and LSD procedures to compare group means. Although there is an increase in test scores for both groups (with Group A improving from a mean of 44.12 to 51.77, and Group B improving from 57.00 to 61.00) after the intervention, the gains are not statistically significant.

As in the analyses for Part I, we used ANCOVA to test for the effects of an interaction between the intervention and the reading scores. For both Groups A and B there was a significant interaction which was independent of any main effect of the intervention (for Group A, $F=5.04$, $p<.01$; for Group B, $F=7.59$, $p<.001$) indicating that students with high reading ability benefit more from the CAI-Syntax treatment, as measured by a test requiring comprehension skills, than do students with lower reading ability.

In order to supplement the results obtained by the statistical analyses of the pre- and post-test scores, an error analysis of the sentences actually produced by the students in Part II of the test was undertaken. The analysis classified all of the mistakes found in the tests into 25 error categories. In addition to the total number of errors found in the total corpus formed by the pre- and post-test responses, Table 1 also reports pre- and post-test results for selected error categories which seemed particularly related to the grammatical procedures taught by the treatment. These categories — some derived from collapsing some of the 25 catgeories originally used in the analysis — are as follows:

Table 1. *Yes-No II* — Summary of Error Analysis

	GROUP A			GROUP B		
	Test 1	Test 2	Test 3	Test 1	Test 2	Test 3
Total number of errors	236	194	198	196	154	165
Selected Error Types						
A	13	15	19	13	6	12
B	54	30	35	37	33	28
C	18	13	22	13	13	12
D	20	15	9	15	24	13
E	11	13	4	13	10	7
F	18	22	15	12	9	14

A. Substitution of a possible pattern for the one expected by the test stimulus (e.g., "How do you feel?" instead of "Were you sick?") This response is not really an error but constitutes a failure of the test to evoke the desired pattern.

B. Confusion of second and third person in the subject to be addressed.

C. Use of a pattern or a total sentence which is semantically impossible in response to the stimulus.

D. A word omitted from what appears otherwise to be a correct response.

E. A word added to an otherwise correct response.

F. The pattern used is incorrect because of confusion in word order.

The error analysis also revealed other frequent errors which are often mentioned in the literature dealing with English produced by the Deaf (e.g., omission of the article, and dropping of verbal and noun morphemes like final "s"). However, further analysis of these errors did not seem germane or relevant to purposes of the intervention and of this report.

Statistical interpretation of the data of Table 1 must be undertaken with some caution, primarily because the error analysis shows only type and frequency of errors in pre- and post-test but not the opportunity to commit them. Opportunities were at best only roughly equivalent between pre- and post-test, primarily because omission of opportunity by totally omitting responses is not taken into account in the error counts, and because students could create their own

opportunities for errors by responding in unexpected patterns. Still, the pre- post-test comparison scores indicate improvement as a result of the intervention. In some categories (like "A"), the decrease in errors may simply be due to the students' recognizing the intention of the treatment and/or the test maker. A gain (i.e., decrease in error) in the other categories (especially "F") seems strongly associated with the success of the intervention. In the case of one error (B) there seems to be an increase from pre- to post-test, namely in the confusion of second and third person (especially the substitution of the third person for the second). This semantic error, which was not specifically dealt with in the treatment, is among the most frequently found in the corpus of pre- and post-test responses and should become the object of further study and planned intervention.

As summarized in Table 1, the frequent mistakes known to relate to specific problems of the Deaf, but not to the experiment under consideration, are omitted in the presentation and appear only in the reported table.

The overall patterning of errors points to the following:

1. The control group (B) seems somewhat stronger than the experimental group throughout all three tests.

2. An overall decrease of errors takes place going from Test 1 to Test 2. The results seem approximately the same for the experiment and control groups, and perhaps is due to familiarity with the type of test being used.

3. The results of the third test administration are not very different from those of the second. Neither retaking of the test (Group A) nor treatment (Group B) change the overall incidence of errors.

The distribution of errors in specific categories does not show a consistent decrease as the result of the preceding treatment. (E.g., a possible treatment effect in error category B in Group A — a drop from 54 in Test 1 to 38 in Test 2 — is not matched by a similar drop in Group B, where the decrease in errors is only from 33 to 28.) It can be noted again that word order confusion — the problem most directly addressed by the treatment — is a less frequent error than the confusion in the person to be used as the intended addressee of the question.

Summary

The data shown in Figure 5 clearly demonstrated the effectiveness of the intervention. Significant gains in syntax knowledge, as measured by Part I of the tests, were made by each

group receiving the CAI-Syntax intervention. In contrast, the control group made no significant gains in each phase. While the means for Group A rose from 63.53 to 74.35 ($p < 0.06$) after the intervention, Group B demonstrated no significant gains with the alternate CAI. After the intervention, however, the means for Group B rose from 70.80 to 87.73 ($p<0.05$). Interestingly, when Group A was tested two weeks after the CAI-Syntax treatment, they retained the syntax knowledge they had acquired earlier. In our experience, these findings are impressive considering the brief duration of the treatments (90 to 135 minutes) and the persistence of these skill deficiencies prior to the treatment.

Two aspects work against the intervention having a pronounced affect on students' syntactic ability, as measured by the open-ended Part II test: (1) The material in Part II is much more difficult than the material in Part I, and (2) deaf students require years of schooling to use the auxiliaries, DOES, DO, and DID (Quigley, 1978) in the test situation and often never reach the point of employing them correctly in spontaneous language production. Under these circumstances, even the marginal gains evidenced after the treatment are encouraging.

Conclusions: Educational Importance

Effecting a change in language behavior that has become ingrained is a difficult, complex, and time-consuming task. As evidenced by the significant results of the intervention, however, it appears that our CAI approach has substantial potential for accelerating the acquisition of English syntactical knowledge by the Deaf. The fact that such meaningful improvement could be obtained in an area where failure is the norm should not be overlooked, especially for an intervention of only two to three class periods.

Although the instructional intervention focused on yes-no question formation, the results of the experiment suggest the desirability of building a complete CAI syntax curriculum based on visualization techniques as linguistic bridges from ASL to English syntactic structures. Visualization and simultaneity of expression in well-designed CAI may be particularly important to the basic concepts in education of the Deaf; these aspects can build on certain strengths of the Deaf that are not utilized in standard teaching materials — those that are visual and spatial like ASL, rather than linear and sequential like English.

As a result, the difficulty of making grammatically correct judgements (as evaluated on Part I of the tests we administered), and the distinctive, ungrammatical deaf syntactic structures that have persisted in spite of years of schooling (as studied in Part II), may be ameliorated. Programs such as the *Yes-No Game* may enable deaf students to proceed through three phases of language learning with more facility: (1) recognition of grammaticality, (2) understanding of rules used in sentence production, and (3) actual production of grammatical sentences for real communication. The results of the *Yes-No Game* indicate a potential breakthrough in the heretofore intractable problems deaf students encounter in attempting to master English syntactic structures.

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APPENDIX 2

The Question Game

Record keeping, error checking, and feedback

Report Generated for: Frank Smith

Who Game - Part 3 - Subject, Verb, Adverbial of Place, Adverbial of Time

Who ice skates in the park every winter ?
Try 1:
Who in the park ice skates every winter who ? Bill Mary <ERASE>

Who in the park ice skates every winter who ? Bill <ERASE>

Who in the park ice skates every winter who ? <ERASE>

Who in the park ice skates every winter who Bill Mary ?

Error: included an answer in the question
Try 2:
Who in the park ice skates every winter who ?

Error: repeated wh-word
Try 3:
Who in the park ice skates every winter ?

Error: misplaced main verb
Try 4:
Who in the park ice skates every winter ?

Error: misplaced main verb
Try 5:
Who ice skates in the park every winter ?

No error
Who jogs at school every Wednesday ?
Try 1:
Who jog at school ?

Error: missing adverbial of time
Try 2:
Who jog every Wednesday <ERASE>

Who jog <ERASE>

Who every Wednesday jog at school ?

Error: incorrect form of the main verb
Try 3:
Who every Wednesday jogs at school ?

Error: misplaced main verb
Try 4:
Who jogs every Wednesday at school ?

Error: misplaced adverbial of place
Try 5:
Who jogs at school every Wednesday ?

No error
Who dances on stage every Friday ?
Try 1:
Who dances on stage every Friday ?

No error

Who Game - Part 3 - Subject, Verb, Direct Object, Adverbial of Place, Adverbial of Time

Who rode ponies in the circus last night ?
Try 1:
Who did rode ponies in the circus last night ?

Error: repeated main verb
Try 2:
Who rode ponies in the circus last night ?

No error
Who planted seeds in the garden yesterday ?
Try 1:
Who planted seeds in the garden yesterday ?

No error

APPENDIX 3

Tests Developed for the TECSD Project

Pre- and post-tests on WH-Questions for the *Question Game* Study

Name _____ School _____

Age _____ Grade ____ Teacher_____

PRE-TEST 1

Read the questions carefully. You should finish the test within 30 minutes. If you finish early, please review your answers carefully.

Part I

Read each group of four (4) questions. Only one of the questions is correct. Choose and mark the correct question with an **X**.

Example 1. Choose the correct question.

A. What did see you at the movies last night?
B. What you saw at the movies last night?
C. What did you see at the movies last night?
D. What was you see at the movies last night?

"C" is the correct question:
What did you see at the movies last night?
The correct letter, "C," is marked below.

A. What did see you at the movies last night?
B. What you saw at the movies last night?
C. What did you see at the movies last night?
D. What was you see at the movies last night?

Example 2. Choose the correct question.

A. Where does play soccer Bill?
B. Where does Bill play soccer ?
C. Where Bill plays soccer?
D. Where is Bill play soccer?

"B" is the correct question:
Where does Bill play soccer ?
Now, mark the correct letter, "B."

A. Where does play soccer Bill?
B. Where does Bill play soccer ?
C. Where Bill plays soccer?
D. Where is Bill play soccer?

BEGIN PART I. For each test item, mark the correct question with an **X**.

1. A. Who is afraid of the spiders are in the closet?
B. Who afraid of the spiders in the closet?
C. Who is afraid of the spiders in the closet?
D. Who are afraid of the spiders in the closet?

2. A. Who drives the bus every day to school?
B. Who the bus drives to school every day?
C. Who drives the bus to school every day?
D. Who the bus to school every day?

3. A. When is the circus is coming to Oakland?
B. When is the circus coming to Oakland?
C. When is coming the circus to Oakland?
D. When the circus comes to Oakland?

4. A. What is looking in the kitchen window?
B. What does looking in the kitchen window?
C. What is looking is in the kitchen window?
D. Is looking what in the kitchen window?

5. A. When Ray hurt his leg at camp?
B. When did Ray hurt his leg at camp?
C. When Ray did hurt his leg at camp?
D. Did Ray hurt his leg at camp when?

6. A. What does watch Mark on TV every Sunday?
B. What does Mark watch on TV every Sunday?
C. What does Mark watch every Sunday on TV?
D. What is Mark watch on TV every Sunday?

7. A. When Sue and Beth are coming for lunch?
B. When are Sue and Beth come for lunch?
C. When is Sue and Beth coming for lunch?
D. When are Sue and Beth coming for lunch?

8. A. What Bob and Jane want for Christmas?
B. What do Bob and Jane want for Christmas?
C. What does Bob and Jane want for Christmas?
D. What do Bob and Jane they want for Christmas?

9. A. Who won the game at school last week?
B. Who the game won at school last week?
C. Who won the game last week at school?
D. Who was won the game at school last week?

10. A. What did the teacher say in class yesterday?
B. Did the teacher what say in class yesterday?
C. What does the teacher say in class yesterday?
D. What the teacher dio say in class yesterday?

11. A. Where Jon and Carl were working last week?
B. Where are Jon and Carl working last week?
C. Where were Jon and Carl working last week?
D. Where Jon and Carl working where last week?

12. A. When is the next baseball game at school?
B. When the next baseball game is at school?
C. Is the next baseball game at school when?
D. When the next baseball game at school?

13. A. Who did jogging in the park yesterday?
B. Who is jogging in the park yesterday?
C. Who was jog in the park yesterday?
D. Who was jogging in the park yesterday?

14. A. What did Mary see last week at the zoo?
B. What did Mary see what at the zoo last week?
C. Mary did see what at the zoo last week ?
D. What did Mary see at the zoo last week ?

15. A. Where are Jeff and Sue their computer fixing?
B. Where is Jeff and Sue fixing their computer?
C. Where are Jeff and Sue fixing their computer?
D. Where Jeff and Sue fixing their computer?

16. A. What was played at the movies last weekend?
B. What was playing at the movies last weekend?
C. What did playing at the movies last weekend?
D. What is playing at the movies last weekend?

17. A. Who was planted flowers in the garden last week?
B. Was planting flowers who in the garden last week?
C. Who was planting flowers in the garden last week?
D. Who flowers was planting in the garden last week?

18. A. When Elise work at the restaurant?
B. When does Elise works at the restaurant?
C. Elise does work at the restaurant when?
D. When does Elise work at the restaurant?

19. A. Where Jack see the show last week?
B. Where did Jack see the show last week?
C. Where does Jack see the show last week?
D. Where did Jack did see the show last week?

20. A. What the mice are eating under the table?
B. What is the mice eating under the table?
C. What the mice eating under the table?
D. What are the mice eating under the table?

21. A. June and Harry's wedding when was?
B. When did June and Harry's wedding ?
C. When was June and Harry's wedding?
D. When June and Harry's wedding was?

22. A. Who is swimming in the pool today?
B. Is swimming in the pool today who?
C. Who is swimming in the pool is today?
D. Who is swimming who in the pool today?

23. A. Where the girls playing ball after school?
B. Where do the girls they play ball after school?
C. Where do the girls play ball after school?
D. Where do the girls do play ball after school?

24. A. What Sam was reading in his room yesterday?
B. What did Sam reading in his room yesterday?
C. What was Sam read in his room yesterday?
D. What was Sam reading in his room yesterday?

25. A. Who cooked dinner at Jill's house last Friday?
B. Who is cooked dinner at Jill's house last Friday?
C. Who cooked dinner last Friday at Jill's house ?
D. Cooked dinner at Jill's house last Friday who?

Name _____

Part II

Directions: Part II contains short paragraphs. First, read each paragraph. Then, write wh-questions that fit each paragraph. Look at the example to see what kinds of questions to write.

Example:

Bill likes to drink lemonade in hot weather. Mary likes soda in the summer and hot chocolate in the winter.

1. who

_____

Write a wh-question on the blank line below.

2. when

_____

Examples: When does Mary drink hot chocolate? When does Bill like to drink lemonade?

Now, write your own wh-question on the line below.

3. what

_____

BEGIN PART II. Read the following short paragraphs. Write 5 appropriate wh-questions for each paragraph.

A. Last summer Mike and Pat traveled to Hawaii for a vacation. Mike tried surfing and hurt his arm. Pat went snorkeling and saw beautiful fish in the water.

1. who

_____

2. when

_____

3. where

_____

4. what

_____

5. who

_____

B. Bess and Toby are having a barbecue in the park. this afternoon They invited all of their friends. Toby is cooking the hamburgers, and Bess is serving the cake and ice cream.

1. when

_____

2. where

_____

3. who

_____

4. what

_____

5. what

_____

Thank you for participating in the Pre-Test. 1

Name _____ School _____

Age _____ Grade ____ Teacher _____

PRE-TEST 2

Read the questions carefully. You should finish the test within 30 minutes. If you finish early, please review your answers carefully.

Part I

Read each group of four (4) questions. Only one of the questions is correct. Choose and mark the correct question with an **X**.

Example 1. Choose the correct question.

A. What did see you at the movies last night?
B. What you saw at the movies last night?
C. What did you see at the movies last night?
D. What was you see at the movies last night?

"C" is the correct question:
What did you see at the movies last night?
The correct letter, "C," is marked below.

A. What did see you at the movies last night?
B. What you saw at the movies last night?
C. What did you see at the movies last night?
D. What was you see at the movies last night?

Example 2. Choose the correct question.

A. Where does play soccer Bill?
B. Where does Bill play soccer ?
C. Where Bill plays soccer?
D. Where is Bill play soccer?

"B" is the correct question:
Where does Bill play soccer ?
Now, mark the correct letter, "B."

A. Where does play soccer Bill?
B. Where does Bill play soccer ?
C. Where Bill plays soccer?
D. Where is Bill play soccer?

BEGIN PART I. For each test item, mark the correct question with an **X**.

1. A. Who is tired of sandwiches are for lunch?
B. Who tired of sandwiches for lunch?
C. Who is tired of sandwiches for lunch?
D. Who are tired of sandwiches for lunch?

2. A. Who rides a bike every day to work?
B. Who a bike rides to work every day?
C. Who rides a bike to work every day?
D. Who a bike to work every day?

3. A. When is the Fair is coming to Fremont?
B. When is the Fair coming to Fremont?
C. When is coming the Fair to Fremont?
D. When the Fair comes to Fremont?

4. A. What is hanging from the kitchen ceiling?
B. What does hanging from the kitchen ceiling?
C. What is hanging is from the kitchen ceiling?
D. Is hanging what from the kitchen ceiling?

5. A. When Dick lose his watch at the movies?
B. When did Dick lose his watch at the movies?
C. When Dick did lose his watch at the movies?
D. Did Dick lose his watch at the movies when?

6. A. What does eat Dad at home every Sunday?
B. What does Dad eat at home every Sunday?
C. What does Dad eat every Sunday at home?
D. What is Dad eat at home every Sunday?

7. A. When Adam and Lee are coming for dinner?
B. When are Adam and Lee come for dinner?
C. When is Adam and Lee coming for dinner?
D. When are Adam and Lee coming for dinner?

8. A. What Kay and Ben plant every spring?
B. What do Kay and Ben plant every spring?
C. What does Kay and Ben plant every spring?
D. What do Kay and Ben they plant every spring?

9. A. Who was the singer in the show last night?
B. Who the singer was in the show last night?
C. Who was the singer last night in the show?
D. Who the singer in the show last night?

10. A. What did the coach say in the gym yesterday?
B. Did the coach what say in the gym yesterday?
C. What does the coach say in the gym yesterday?
D. What the coach did say in the gym yesterday?

11. A. Where Don and Ray were studying last night?
B. Where are Don and Ray studying last night?
C. Where were Don and Ray studying last night?
D. Where Don and Ray studying where last night?

12. A. When is the homecoming dance at school?
B. When the homecoming dance is at school?
C. Is the homecoming dance at school when?
D. When the homecoming dance at school?

13. A. Who did digging in the garden yesterday?
B. Who is digging in the garden yesterday?
C. Who was dig in the garden yesterday?
D. Who was digging in the garden yesterday?

14. A. What did Amy buy yesterday at the store?
B. What did Amy buy what at the store yesterday?
C. Amy did buy what at the store yesterday?
D. What did Amy buy at the store yesterday?

15. A. Where are Ted and Sara their new car buying?
B. Where is Ted and Sara buying their new car?
C. Where are Ted and Sara buying their new car?
D. Where Ted and Sara buying their new car?

16. A. What was bloomed in the garden last summer?
B. What was blooming in the garden last summer?
C. What did blooming in the garden last summer?
D. What is blooming in the garden last summer?

17. A. Who was picked apples in the orchard last week?
B. Was picking apples who in the orchard last week?
C. Who was picking apples in the orchard last week?
D. Who apples was picking in the orchard last week?

18. A. When Daisy swim in the ocean?
B. When does Daisy swims in the ocean?
C. Daisy does swim in the ocean when?
D. When does Daisy swim in the ocean?

19. A. Where Josh find his bike last week?
B. Where did Josh find his bike last week?
C. Where does Josh find his bike last week?
D. Where did Josh did find his bike last week?

20. A. What the cats are chasing in the yard?
B. What is the cats chasing in the yard?
C. What the cats chasing in the yard?
D. What are the cats chasing in the yard?

21. A. Jay and Ann's anniversary when was?
B. When did Jay and Ann's anniversary
C. When was Jay and Ann's anniversary?
D. When Jay and Ann's anniversary was?

22. A. Who is serving in the cafeteria today?
B. Is serving in the cafeteria today who?
C. Who is serving in the cafeteria is today?
D. Who is serving who in the cafeteria today?

23. A. Where the boys riding horses today?
B. Where do the boys they ride horses today?
C. Where do the boys ride horses today?
D. Where do the boys do ride horses today?

24. A. What Tony was fixing in his room yesterday?
B. What did Tony fixing in his room yesterday?
C. What was Tony fix in his room yesterday?
D. What was Tony fixing in his room yesterday?

25. A. Who baked cookies at Eve's house last night?
B. Who is baked cookies at Eve's house last night?
C. Who baked cookies last night at Eve's house?
D. Baked cookies at Eve's house last night who?

Name _____

Part II

Directions: Part II contains short paragraphs. First, read each paragraph. Then, write wh-questions that fit each paragraph. Look at the example to see what kinds of questions to write.

Example:

Bill likes to drink lemonade in hot weather. Mary likes soda in the summer and hot chocolate in the winter.

1. who

_____

Write a wh-question on the blank line below.

2. when

_____

Examples: When does Mary drink hot chocolate? When does Bill like to drink lemonade?

Now, write your own wh-question on the line below.

3. what

_____

BEGIN PART II. Read the following short paragraphs. Write 5 appropriate wh-questions for each paragraph.

A. Moly and Rick drove to Yosemite for a vacation last winter. Molly went skiing and twisted her ankle. Rick went hiking and saw deer and squirrels.

1. who

_____

2. when

_____

3. where

_____

4. what

_____

5. who

_____

B. Sally and Jim are having a party at their home tonight. The party is for Jim's birthday. All of their friends are coming. Sally baked a wonderful birthday cake.

1. when

_____

2. where

_____

3. who

_____

4. what

_____

5. what

_____

Thank you for participating in the Pre-Test. 1

Name _____ School _____

Age _____ Grade ____ Teacher_____

TEST 3

Read the questions carefully. You should finish the test within 30 minutes. If you finish early, please review your answers very carefully.

Part I

Read each group of four (4) questions. Only one of the questions is correct. Choose and mark the correct question with an **X**.

Example 1. Choose the correct question.

A. What did see you at the movies last night?
B. What you saw at the movies last night?
C. What did you see at the movies last night?
D. What was you see at the movies last night?

"C" is the correct question:
What did you see at the movies last night?
The correct letter, "C," is marked below.

A. What did see you at the movies last night?
B. What you saw at the movies last night?
C. What did you see at the movies last night?
D. What was you see at the movies last night?

Example 2. Choose the correct question.

A. Where does play soccer Bill?
B. Where does Bill play soccer ?
C. Where Bill plays soccer?
D. Where is Bill play soccer?

"B" is the correct question:
Where does Bill play soccer ?
Now, mark the correct letter, "B."

A. Where does play soccer Bill?
B. Where does Bill play soccer ?
C. Where Bill plays soccer?
D. Where is Bill play soccer?

BEGIN PART I. For each test item, mark the correct question with an **X**.

1. A. Who is hungry for cookies are from the bakery?
B. Who hungry for cookies from the bakery?
C. Who is hungry for cookies from the bakery?
D. Who are hungry for cookies from the bakery?

2. A. Who cleans the kitchen every weekend at home?
B. Who the kitchen cleans at home every weekend
C. Who cleans the kitchen at home every weekend?
D. Who the kitchen at home every weekend?

3. A. When is Joe Montana is coming to CSDF?
B. When is Joe Montana coming to CSDF?
C. When is coming Joe Montana to CSDF?
D. When Joe Montana comes to CSDF?

4. A. What is cooking on the kitchen stove?
B. What does cooking on the kitchen stove?
C. What is cooking is on the kitchen stove?
D. Is cooking what on the kitchen stove?

5. A. When Bonnie see the bear at Yosemite?
B. When did Bonnie see the bear at Yosemite?
C. When Bonnie did see the bear at Yosemite?
D. Did Bonnie see the bear at Yosemite when?

6. A. What does bring Ed to school every Monday?
B. What does Ed bring to school every Monday?
C. What does Ed bring every Monday to school?
D. What is Ed bring to school every Monday?

7. A. When Les and Lily are going to New York?
B. When are Les and Lily go to New York?
C. When is Les and Lily going to New York?
D. When are Les and Lily going to New York?

8. A. What Eve and Sally want for breakfast?
B. What do Eve and Sally want for breakfast?
C. What does Eve and Sally want for breakfast?
D. What do Eve and Sally they want for breakfast?

9. A. Who saw the Superbowl on TV last month?
B. Who the Superbowl saw on TV last month?
C. Who saw the Superbowl last month on TV?
D. Who was saw the Superbowl on TV last month?

10. A. What did Bill play at the party last night?
B. Did Bill what play at the party last night?
C. What does Bill play at the party last night?
D. What Bill did play at the party last night?

11. A. Where Tom and Jim were hiking last Sunday?
B. Where are Tom and Jim hiking last Sunday?
C. Where were Tom and Jim hiking last Sunday?
D. Where Tom and Jim hiking where last Sunday?

12. A. When is the Halloween party at school?
B. When the Halloween party is at school?
C. Is the Halloween party at school when?
D. When the Halloween party at school?

13. A. Who did exercising in the gym yesterday?
B. Who is exercising in the gym yesterday?
C. Who was exercise in the gym yesterday?
D. Who was exercising in the gym yesterday?

14. A. What did Andy cook yesterday for dinner?
B. What did Andy cook what for dinner yesterday?
C. Andy did cook what for dinner yesterday?
D. What did Andy cook for dinner yesterday?

15. A. Where are Dan and Jane their bikes fixing?
B. Where is Dan and Jane fixing their bikes?
C. Where are Dan and Jane fixing their bikes?
D. Where Dan and Jane fixing their bikes?

16. A. What was played at the theater last Saturday?
B. What was playing at the theater last Saturday?
C. What did playing at the theater last Saturday?
D. What is playing at the theater last Saturday?

17. A. Who was painted the fence in the yard last weekend?
B. Was painting the fence who in the yard last weekend?
C. Who was painting the fence in the yard last weekend?
D. Who the fence was painting in the yard last weekend?

18. A. When Emily works at Burger King?
B. When does Emily works at Burger King?
C. Emily does work at Burger King when?
D. When does Emily work at Burger King?

19. A. Where Bud have a flat tire last week?
B. Where did Bud have a flat tire last week?
C. Where does Bud have a flat tire last week?
D. Where did Bud did have a flat tire last week?

20. A. What the students are reading in the library?
B. What is the students reading in the library?
C. What the students reading in the library?
D. What are the students reading in the library?

21. A. Mom and Dad's vacation when was?
B. When did Mom and Dad's vacation?
C. When was Mom and Dad's vacation?
D. When Mom and Dad's vacation was?

22. A. Who is dancing in the show today?
B. Is dancing in the show today who?
C. Who is dancing in the show is today?
D. Who is dancing who in the show today?

23. A. Where the cats catching mice at night?
B. Where do the cats they catch mice at night?
C. Where do the cats catch mice at night?
D. Where do the cats do catch mice at night?

24. A. What Nan was typing in class yesterday?
B. What did Nan typing in class yesterday?
C. What was Nan type in class yesterday?
D. What was Nan typing in class yesterday?

25. A. Who showed slides at the party last week?
B. Who is showed slides at the party last week?
C. Who showed slides last week at the party?
D. Showed slides at the party last week who?

Name _____

Part II

Directions: Part II contains short paragraphs. First, read each paragraph. Then, write wh-questions that fit each paragraph. Look at the example to see what kinds of questions to write.

Example:

Bill likes to drink lemonade in hot weather. Mary likes soda in the summer and hot chocolate in the winter.

1. who

_____

Write a wh-question on the blank line below.

2. when

_____

Examples: When does Mary drink hot chocolate? When does Bill like to drink lemonade?

Now, write your own wh-question on the line below.

3. what

_____

BEGIN PART II. Read the following short paragraphs. Write 5 appropriate wh-questions for each paragraph.

A. Charlie Brown is happy. He passed his spelling test at school yesterday. Charlie is sitting on the front step and eating an ice cream cone. Snoopy is eating an ice cream cone too.

1. who

_____

2. when

_____

3. where

_____

4. what

_____

5. who

_____

B. Lisa and Bob love animals. Lisa has a hamster, and Bob has a white mouse. Beth went to the pet store yesterday and bought a big white rabbit. She named the rabbit "Harvey."

1. when

_____

2. where

_____

3. who

_____

4. what

_____

5. what

_____

6. who

_____

Thank you for participating in the Pre-Test. 1

A Teacher's Guide to:

The Question Game

Teaching English Syntax to the Deaf

Acknowledgement:

This software was developed as part of *Technology for English Communication Skills for the Deaf (TECSD)*, a federally funded research and development effort of the New Technology Research Center. Funding of 100% of the project costs, in the amount of $154,943, was provided by the Office of Special Education Programs of the U.S. Department of Education — Program #84.180, Project #H180P90014.

Table of Contents

Introduction

Most of us never need to learn how to order words in an English sentence. We have heard the language spoken, from the very first months of our lives. At a very young age we have learned enough of what our language is supposed to sound like that we know immediately if a sentence seems correct, or somehow jumbled. Putting words in the right order when we speak rarely requires thought, so deeply internalized is our sense of correct syntax in our mother tongue. When we order words in written expression, little more is required than to imagine that we are speaking the words, and "listen" to see if they sound right.

As teachers of the Deaf well know, many deaf students with severe hearing impairments have missed the opportunity to learn what sounds right. These students cannot rely on an inner voice to guide their choice of word order. Instead, they must learn English syntax, as if they were learning a foreign language.

One has only to consider the literacy statistics for the Deaf to appreciate how much of an obstacle severe hearing impairment creates in the development of language skills. The average deaf adult reads at the fourth grade level. Only 10 percent of the very best 18-year-old deaf students read above the eight grade level.

The traditional problem in teaching language skills to the Deaf is that the two traditional modalities of instruction, the recitation and the book, cannot be used. Because under-developed reading skills are highly correlated with underdeveloped verbal expression skills, language instruction provided through written materials is rarely an answer.

Against the dim backdrop of this historically intractable problem, computer technologies cast a bright new light. Computers can present a non-auditory language environment which is, in principle, nearly as rich as the auditory environments in which most verbal communications skills are nourished. Where textual messages would be difficult, computers can be graphical and iconic. Where human instructors tire, computers can be patient and unwaveringly accurate. Where learners motivation wavers when confronted with page after page of textbook instruction, computers can embed educational materials in motivating and engaging games, using time-tested reinforcement techniques to sustain interest and alertness.

It was this promise of new technologies to which the Office of Special Education Programs of the U.S. Department of Education responded in providing funding for the development of this program. The *Question Game* begins what we hope will be a series of technology-based curriculum development efforts that make the benefits of the latest in computer technology and the most current principles of instructional design available to the Deaf.

This program was developed after nearly four years of research, working closely with students and teachers at the California School for the Deaf in Fremont. It is based upon a thorough investigation of the kinds of syntax problems that occur with significant frequency for the Deaf. It is also based upon instructional methods that have been tried, tuned, retried and retuned until we know that they are highly effective and very engaging.

Finally, the program has been designed so that it is easy for both teachers and students to use. Because most deaf students have had limited, if any, access to Macintosh computers, the program begins by teaching how to sign-in to the program, and how to use a "mouse" for computer control. Because most teachers are extremely busy managing the day-to-day instruction in their classrooms, the program is designed so that learners can progress

through a set of lesson-games with no teacher involvement, unless the teacher elects to monitor learner progress or assign particular segments of the program to particular learners. As we will describe in this guide, for the teacher who wants to understand clearly what English syntax skills particular learners possess, detailed records of learner interactions with the program reveal much about where learners have strengths, and where they have weaknesses.

Getting Started

This new version of *The Question Game* is supplied on two disks, *The Question Game - 1* and *The Question Game - 2*. Before you can use this program, you will need to transfer it to your Macintosh's hard disk.

It will run properly on every Macintosh that:

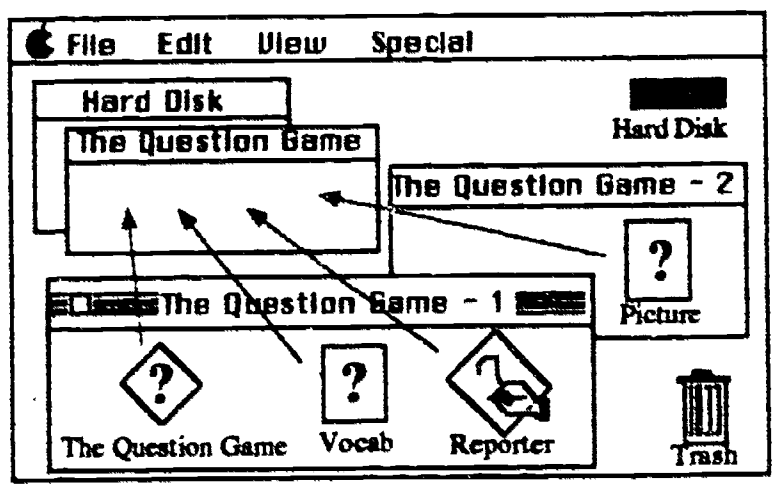
- Has a hard disk with 1.1 MB of disk space available
- Uses system 6.04 or greater, and
- Has at least 1 MB of internal memory.

The following instruction on installing The Question Game assume that you are familiar with the operating system of the Macintosh. If you need more information about the rudiments of folders and the operation of the mouse, please consult your Macintosh Reference Manual.

Installing *The Question Game*

To install The Question Game on your hard disk, follow these steps:

1. Start your computer.
2. Create a new file folder named *The Question Game* to contain the software.



3. Put *The Question Game -1* into the disk drive.
4. Double-click on the disk icon to show the disk files.
5. Drag *The Question Game*, *Vocab*, and *Reporter* from *The Question Game - 1* disk file to the new *The Question Game* file folder you made on your hard disk.
6. Drag *The Question Game - 1* disk icon to the trash to eject it from the computer.
7. Insert *The Question Game - 2* into the disk drive.
8. Double-click on the disk icon to show the files on this disk.
9. Drag *Picture* from *The Question Game - 2* disk file to the new *The Question Game* file folder you made on your hard disk.
10. Drag the *Question-Game -2* disk icon to the trash to eject it from the computer.

You have now completed the installation of the program. The *Question Game* file folder you created on your hard disk contains:

- *The Question Game*
- *Vocab*
- *Reporter*, and
- *Pictures*.

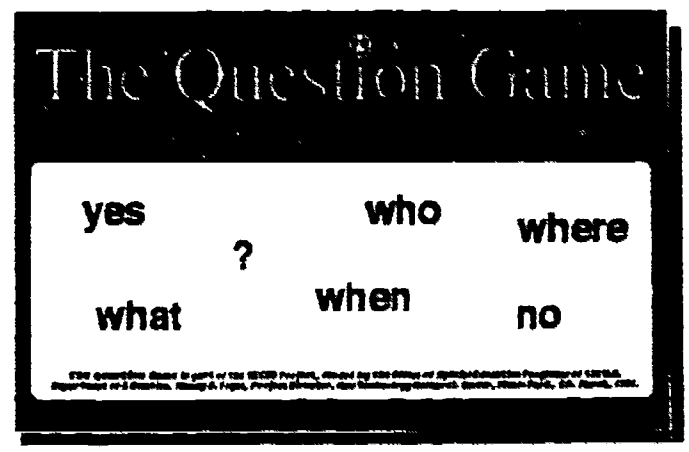
All four of these files, with these names, must be located in this file folder for the program to function correctly (although there is nothing wrong with your changing the name of the file folder). As your students use the program, records of their performance, identified by their name, will also be found in this file. The process of automatically generating records will be discussed in more detail in the *Student Records* section of this *Teacher's Guide*.

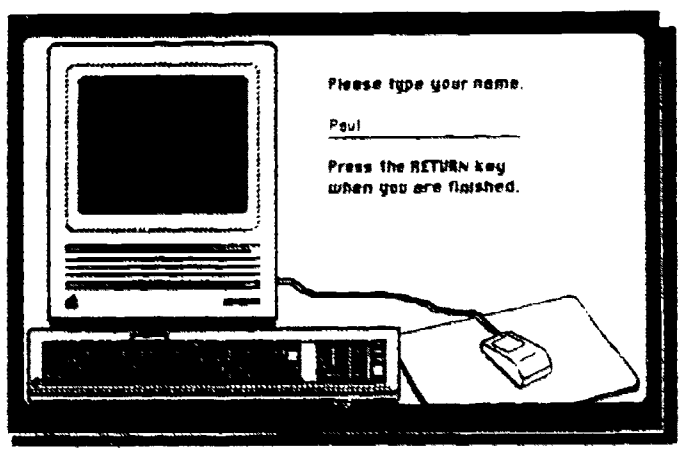
Starting *The Question Game*

To run *The Question Game:*

1. Open *The Question Game* file folder.
2. Double-click on the *The Question Game* icon.
3. The title screen, shown below, will appear and begin to animate.

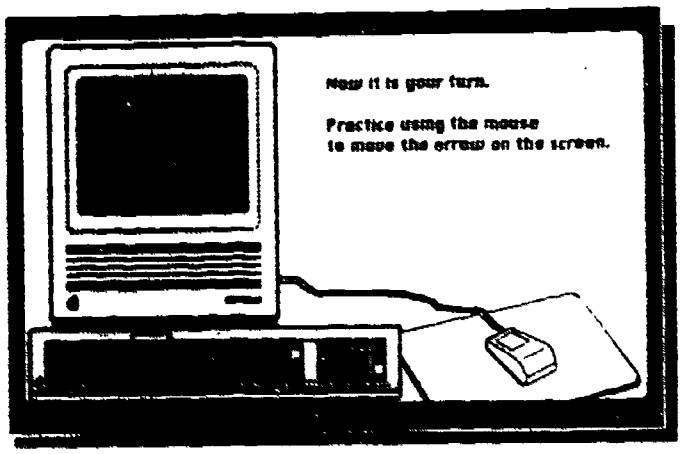
The animation will continue for about 10 seconds, or until the learner presses the *return* key.

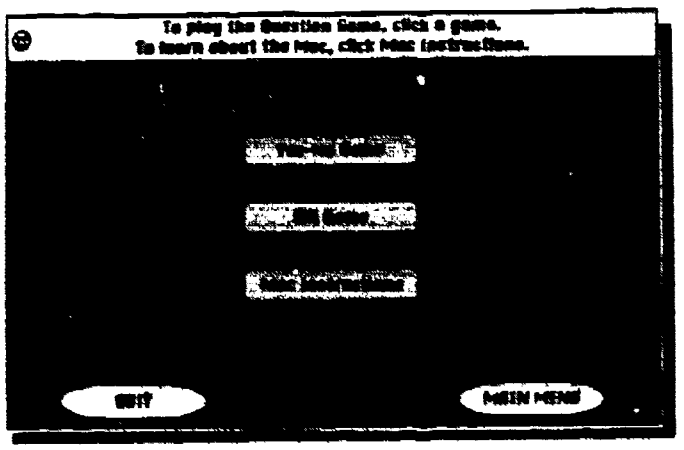




A sign-in screen appears, so the student can enter his or her name. **You should be sure that no two individuals enter the same name** because the program uses the student's name to record performance information.

The first time the student uses *The Question Game*, the program assumes that the student has no experience with Macintosh computers and presents an easy, short, very graphical introduction to using the mouse to control the computer.



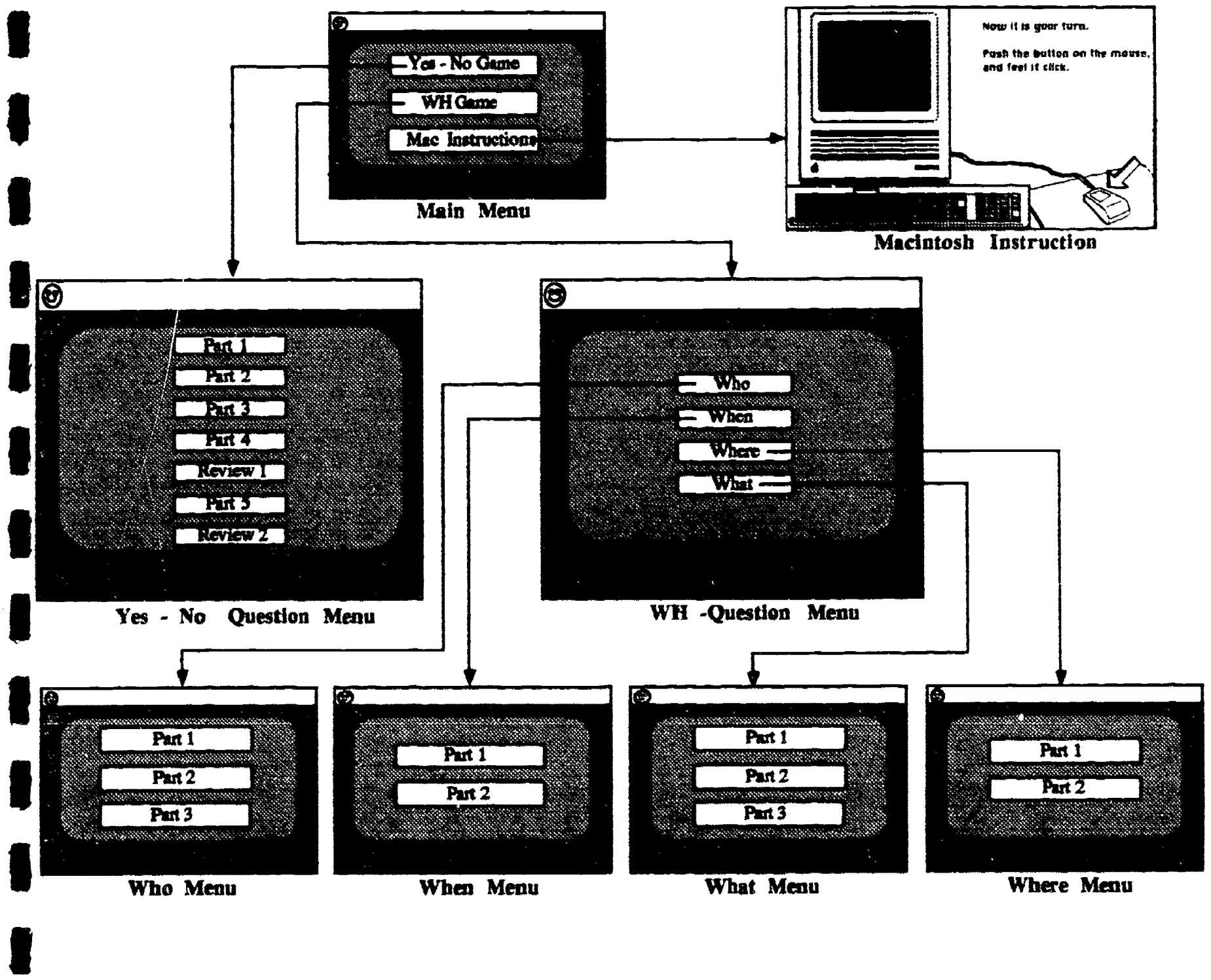


If the student has already used *The Question Game*, the program recognizes his or her name and takes the user to the "main menu" screen, from which any lesson can be accessed. The learner needs to keep track of his or her progress and return to the correct part of the program when continuing.

How the Program is Organized

Overview

The Question Game is divided into three main sections: The Yes-No Game, The WH-Game and the Macintosh Instructions. Even though the Macintosh Instructions are presented automatically to the first-time user, they can be accessed at any time from the Main Menu for review. Selection of the appropriate lesson by a student simply involves pointing the mouse-cursor at any one of the "boxed selections" shown below, and clicking the mouse.



Instructional Content

The *Yes-No Game* is composed of seven parts, which provide multiple opportunities to build yes-no questions with single and plural subjects, as well as present and past tense verbs. Each part contains three to ten structures of increasing length and documented difficulty for the Deaf.

- YES-NO

Part 1:	BE as a main verb
Part 2:	BE as an auxiliary with regular verbs
Part 3:	Regular verbs with the DOES auxiliary
Part 4:	Regular verbs with the DO auxiliary
Review 1:	Regular verbs with the auxiliaries, DOES and DO
Part 5:	Regular verbs with the DID auxiliary
Review 2:	Regular verbs with the auxiliaries, DOES, DO, and DID

The *WH-Game* is composed of four sections: WHO, WHEN, WHERE, and WHAT. Each section has two to three parts with opportunities to build wh-questions with single and plural subjects, present and past tense verbs, and regular and irregular verbs. In each part, the questions to be built are increased in length and difficulty as the student progresses.

- WHO:

Part 1:	BE as a main verb
Part 2:	BE as an auxiliary with regular and irregular verbs
Part 3: and	Regular and irregular verbs with the auxiliaries, DOES, DO, DID

- WHEN:

Part 1:	BE as a main verb
Part 2:	BE as a main verb with longer structures

- WHERE:

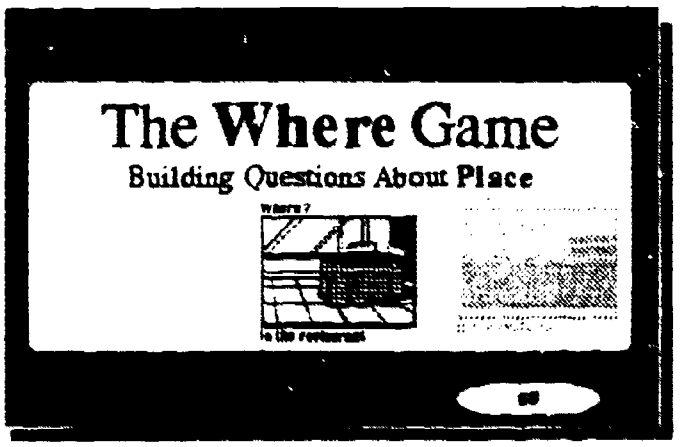
Part 1:	BE as a main verb and as an auxiliary with regular and irregular verbs
Part 2:	Regular and irregular verbs with the auxiliaries, DOES, DO, and DID

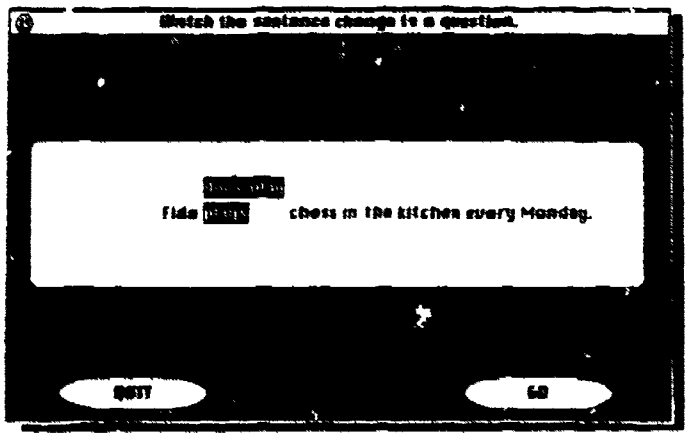
- WHAT:

Part 1:	BE as a main verb
Part 2:	BE as a main verb with longer structures
Part 3:	Regular and irregular verbs with the auxiliaries, DOES, DO, and DID

Structure of Each Section

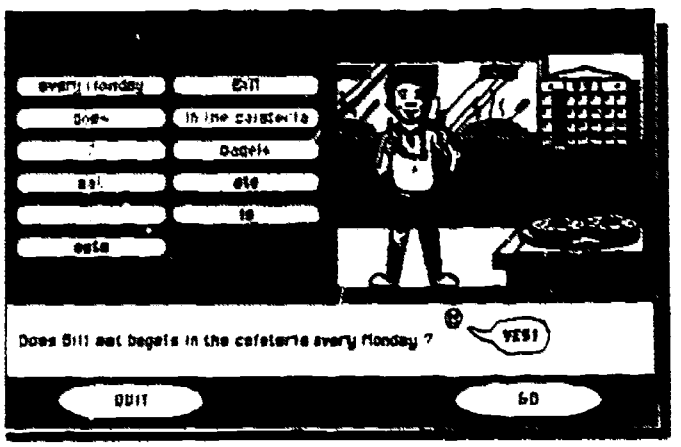
Throughout the *Question Game*, title screens introduce each section.

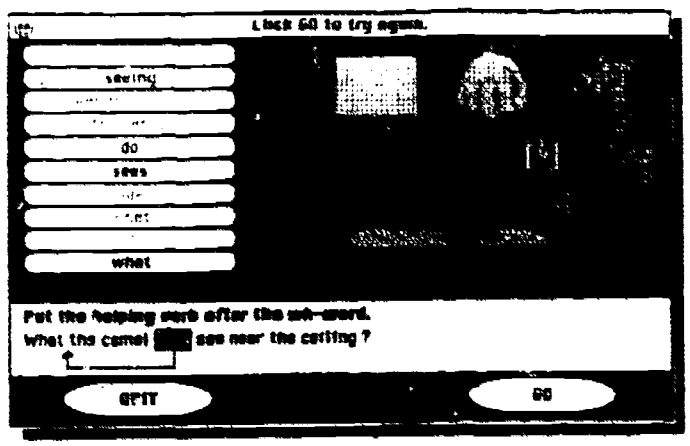




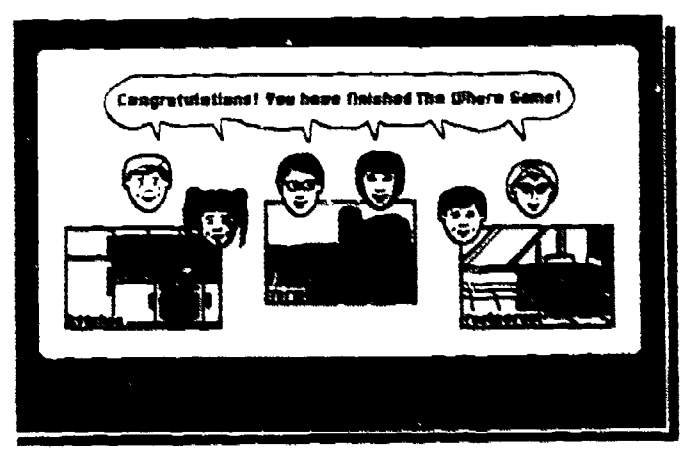
Each part of the *Yes-No Game* and the *Wh-Question Game* begins with a modeling of how to build the particular questions in that part.

A "build-a-question" screen lets students construct questions of words, placed in the order in which the words are chosen from a list, which is carefully designed to provide opportunities for students to make common types of syntax errors. A simple consistent interface is used. Students can always click on the QUIT button to exit the program, or the GO button to continue to play. The ERASE button lets students correct errors they may have made in their selection of words from the list.





Once an error has been detected, the program provides very precise and easily understood corrective feedback. Students are given practice items until they reach a mastery level for each syntactical structure. At this point they are automatically advanced to the next structure.



Congratulation screens conclude each section successfully completed and return the student to the main menu — from where they can exit the program or select another section of the *Question Game*.

Student Records

The program automatically creates a record of the entire session a student has had with *The Question Game*. The record is saved in the file folder that contains the game. It has the same name that the student typed when logging on to the program.

The record indicates which section(s) and part(s) of the program were used. For example, a record might begin with:

```
Yes No Game - Part 2 - Subject, BE-verb, Progressive Verb, Direct
Object.
```

The correct question is then listed. For example:

```
Are Dad and Beth cooking pizza?
```

The question is followed by a complete list of tries:

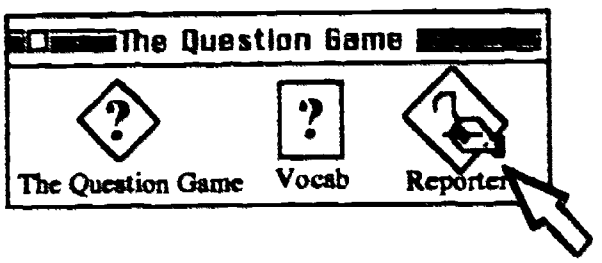
```
Try 1:  Are Dad and Beth pizza?
Error:  Missing progressive verb.

Try 2:  Are Dad and Beth cooking pizza?
No Error.
```

The detail in these records can be an invaluable source of information about the specific syntax skill level of each learner. A sample record from a student's session is included at the end of this guide for your reference.

Please note that in order to conserve space on your hard disk, the program only saves the record from the learner's last session. If you find these records useful in working with your students and tracking their progress, remember to print them between student sessions so that you can file them for later review; otherwise, the data from the next student session will overwrite the prior data and you will not be able to retrieve it.

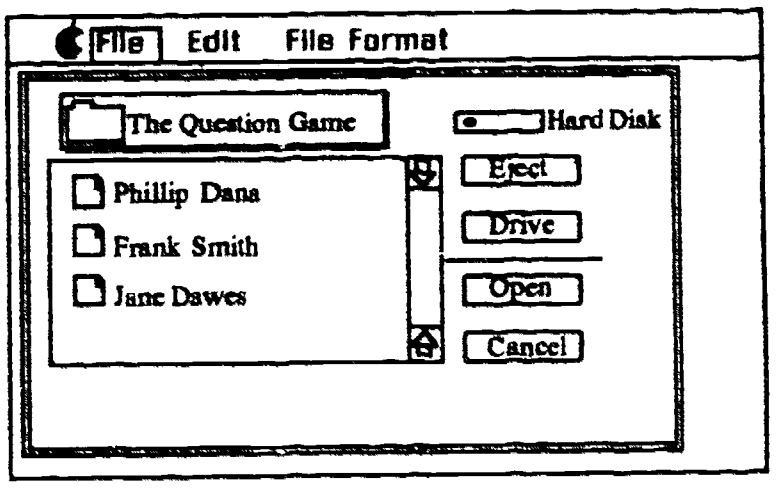
Accessing Student Records



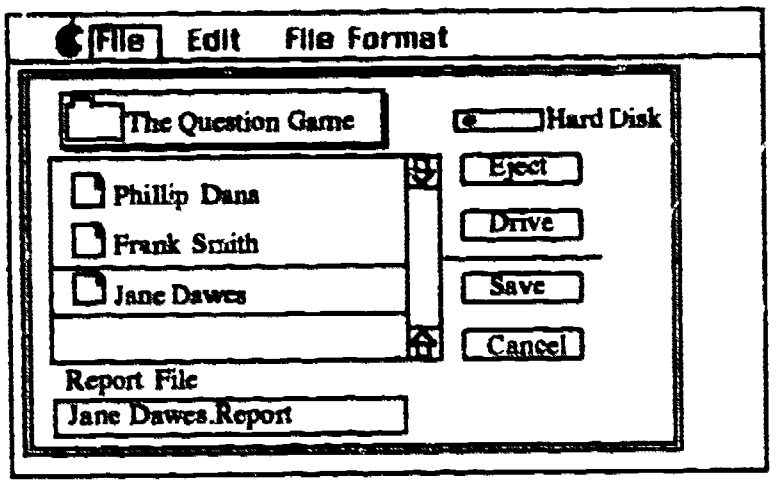
To create and print a student's record, you should open *The Question Game* folder and double-click on the *Reporter* icon.

The menu bar will change so that only "File", "Edit", and "File Format" are visible. You can use the "File Format" menu to create a report so that it can be read by either MicroSoft Word or MacWrite word processors.

Next, open the "File" menu and click on "Generate" (for generate a report). A student selection screen, as shown on the right, will let you scroll through the list of students and highlight the one whose report you want to print. When you have done this, click on the "Open" button.



When you click on the "Open" button it actually creates the report in the computer's memory. You are now ready to save the report to your hard disk, and the screen changes, as shown in the next illustration, to allow you to do this.



In place of the "Open" button a "Save" button will appear. A default name (the student's name with ".report" appended) will appear in a new "Report File" box. You can move your mouse cursor over to this box and edit the name of the report file. Usually you will simply click on the "Save" button and the report will be saved to your hard disk, in a word-processor readable format, and placed inside *The Question Game* folder.

To exit from the Reporter program, open the "File" menu on the menu-bar and click on "Quit."

To open a report you have generated, in order to review it on-screen or print it, you open *The Question Game* folder and double-click on the icon of the report you are interested in. This will open the document within either *MacWrite* or MicroSoft *Word*, whichever you have chosen. If you have a different word processor from either of these, it will probably still be able to read the report file by importing it as ASCII text. Consult your word processor manual to see how this is done.

Tips On Using The Program With Your Students

Here are several recommendations for using *The Question Game* most effectively:

- Limit the length of a session for elementary school children to less than 30 minutes.

- Limit the length of a session for older children to less than 50 minutes.

- It is usually more effective to have a student use *The Question Game* every other day, rather than every day. The program retains its freshness and appeal longer this way.

- Even after students have finished all the lessons, which usually takes a total of four or five hours of cumulative time with the program, periodic refresher sessions are effective. Because of the large number of pictures and the sizable vocabulary students will see different exercise materials each time they go back to the program.

- Most students will work through the material without any great difficulty. It is more important to review the automatically generated records of the few students who are not making rapid progress on their own, than the many who are.

- A *Student Progress Sheet* has been included with this *Teacher's Guide*. It is a copyable form to hand out to students so that they can check off the lessons as they do them. This will make it easier for them, when they exit the program, to determine where they should begin again at their next session. It also provides teachers with a form they can glance at to check how quickly the students are moving through the lessons.

- For those who are interested in testing to determine quantitatively how much progress has been made by students working with *The Question Game*, the pre and post-tests which were used in field testing the program are included with this *Teacher's Guide*.

Sample Student Record

Who Game - Part 3 - Subject, Verb, Adverbial of Place, Adverbial of Time

Who ice skates in the park every winter ?
Try 1:
Who in the park ice skates every winter who ? Bill Mary <ERASE>

Who in the park ice skates every winter who ? Bill <ERASE>

Who in the park ice skates every winter who ? <ERASE>

Who in the park ice skates every winter who Bill Mary ?

Error: included an answer in the question
Try 2:
Who in the park ice skates every winter who ?

Error: repeated wh-word
Try 3:
Who in the park ice skates every winter ?

Error: misplaced main verb
Try 4:
Who in the park ice skates every winter ?

Error: misplaced main verb
Try 5:
Who ice skates in the park every winter ?

No error
Who jogs at school every Wednesday ?
Try 1:
Who jog at school ?

Error: missing adverbial of time
Try 2:
Who jog every Wednesday <ERASE>

Who jog <ERASE>

Who every Wednesday jog at school ?

Error: incorrect form of the main verb
Try 3:
Who every Wednesday jogs at school ?

Error: misplaced main verb
Try 4:
Who jogs every Wednesday at school ?

Error: misplaced adverbial of place
Try 5:
Who jogs at school every Wednesday ?

No error
Who dances on stage every Friday ?
Try 1:
Who dances on stage every Friday ?

No error

Who Game - Part 3 - Subject, Verb, Direct Object, Adverbial of Place, Adverbial of Time

Who rode ponies in the circus last night ?
Try 1:
Who did rode ponies in the circus last night ?

Error: repeated main verb
Try 2:
Who rode ponies in the circus last night ?

No error
Who planted seeds in the garden yesterday ?
Try 1:
Who planted seeds in the garden yesterday ?

No error

STUDENT PROGRESS SHEET

Name _____

Put a check in the box ☑ after each lesson when you have completed it.

The Macintosh Instructions ☐

The Yes-No Game:

- Part 1 ☐
- Part 2 ☐
- Part 3 ☐
- Part 4 ☐
- Review 1 ☐
- Part 5 ☐
- Review 2 ☐

The Who Game:

- Who: Part 1 ☐
  - Part 2 ☐
  - Part 3 ☐
- When: Part 1 ☐
  - Part 2 ☐
- Where: Part 1 ☐
  - Part 2 ☐
- What: Part 1 ☐
  - Part 2 ☐
  - Part 3 ☐

Name _____ School _____

Age _____ Grade ____ Teacher_____

PRE-TEST

Read the questions carefully. You should finish the test within 30 minutes. If you finish early, please review your answers carefully.

Part I

Read each group of four (4) questions. Only one of the questions is correct. Choose and mark the correct question with an **X**.

Example 1. Choose the correct question.

A. What did see you at the movies last night?
B. What you saw at the movies last night?
C. What did you see at the movies last night?
D. What was you see at the movies last night?

"C" is the correct question:
What did you see at the movies last night?
The correct letter, "C," is marked below.

A. What did see you at the movies last night?
B. What you saw at the movies last night?
X What did you see at the movies last night?
D. What was you see at the movies last night?

Example 2. Choose the correct question.

A. Where does play soccer Bill?
B. Where does Bill play soccer ?
C. Where Bill plays soccer?
D. Where is Bill play soccer?

"B" is the correct question:
Where does Bill play soccer ?
Now, mark the correct letter, "B."

A. Where does play soccer Bill?
B. Where does Bill play soccer ?
C. Where Bill plays soccer?
D. Where is Bill play soccer?

BEGIN PART I. For each test item, mark the correct question with an **X**.

1. A. Who is afraid of the spiders are in the closet?
B. Who afraid of the spiders in the closet?
C. Who is afraid of the spiders in the closet?
D. Who are afraid of the spiders in the closet?

2. A. Who drives the bus every day to school?
B. Who the bus drives to school every day?
C. Who drives the bus to school every day?
D. Who the bus to school every day?

3. A. When is the circus is coming to Oakland?
B. When is the circus coming to Oakland?
C. When is coming the circus to Oakland?
D. When the circus comes to Oakland?

4. A. What is looking in the kitchen window?
B. What does looking in the kitchen window?
C. What is looking is in the kitchen window?
D. Is looking what in the kitchen window?

5. A. When Ray hurt his leg at camp?
B. When did Ray hurt his leg at camp?
C. When Ray did hurt his leg at camp?
D. Did Ray hurt his leg at camp when?

6. A. What does watch Mark on TV every Sunday?
B. What does Mark watch on TV every Sunday?
C. What does Mark watch every Sunday on TV?
D. What is Mark watch on TV every Sunday?

7. A. When Sue and Beth are coming for lunch?
B. When are Sue and Beth come for lunch?
C. When is Sue and Beth coming for lunch?
D. When are Sue and Beth coming for lunch?

8. A. What Bob and Jane want for Christmas?
B. What do Bob and Jane want for Christmas?
C. What does Bob and Jane want for Christmas?
D. What do Bob and Jane they want for Christmas?

9. A. Who won the game at school last week?
B. Who the game won at school last week?
C. Who won the game last week at school?
D. Who was won the game at school last week?

10. A. What did the teacher say in class yesterday?
B. Did the teacher what say in class yesterday?
C. What does the teacher say in class yesterday?
D. What the teacher did say in class yesterday?

11. A. Where Jon and Carl were working last week?
B. Where are Jon and Carl working last week?
C. Where were Jon and Carl working last week?
D. Where Jon and Carl working where last week?

12. A. When is the next baseball game at school?
B. When the next baseball game is at school?
C. Is the next baseball game at school when?
D. When the next baseball game at school?

13. A. Who did jogging in the park yesterday?
B. Who is jogging in the park yesterday?
C. Who was jog in the park yesterday?
D. Who was jogging in the park yesterday?

14. A. What did Mary see last week at the zoo?
B. What did Mary see what at the zoo last week?
C. Mary did see what at the zoo last week ?
D. What did Mary see at the zoo last week ?

15. A. Where are Jeff and Sue their computer fixing?
B. Where is Jeff and Sue fixing their computer?
C. Where are Jeff and Sue fixing their computer?
D. Where Jeff and Sue fixing their computer?

16. A. What was played at the movies last weekend?
B. What was playing at the movies last weekend?
C. What did playing at the movies last weekend?
D. What is playing at the movies last weekend?

17. A. Who was planted flowers in the garden last week?
B. Was planting flowers who in the garden last week?
C. Who was planting flowers in the garden last week?
D. Who flowers was planting in the garden last week?

18. A. When Elise work at the restaurant?
B. When does Elise works at the restaurant?
C. Elise does work at the restaurant when?
D. When does Elise work at the restaurant?

19. A. Where Jack see the show last week?
B. Where did Jack see the show last week?
C. Where does Jack see the show last week?
D. Where did Jack did see the show last week?

20. A. What the mice are eating under the table?
B. What is the mice eating under the table?
C. What the mice eating under the table?
D. What are the mice eating under the table?

21. A. June and Harry's wedding when was?
B. When did June and Harry's wedding ?
C. When was June and Harry's wedding?
D. When June and Harry's wedding was?

22. A. Who is swimming in the pool today?
B. Is swimming in the pool today who?
C. Who is swimming in the pool is today?
D. Who is swimming who in the pool today?

23. A. Where the girls playing ball after school?
B. Where do the girls they play ball after school?
C. Where do the girls play ball after school?
D. Where do the girls do play ball after school?

24. A. What Sam was reading in his room yesterday?
B. What did Sam reading in his room yesterday?
C. What was Sam read in his room yesterday?
D. What was Sam reading in his room yesterday?

25. A. Who cooked dinner at Jill's house last Friday?
B. Who is cooked dinner at Jill's house last Friday?
C. Who cooked dinner last Friday at Jill's house ?
D. Cooked dinner at Jill's house last Friday who?

Name _____

Part II

Directions: Part II contains short paragraphs. First, read each paragraph. Then, write wh-questions that fit each paragraph. Look at the example to see what kinds of questions to write.

Example:

Bill likes to drink lemonade in hot weather. Mary likes soda in the summer and hot chocolate in the winter.

1. who

Who likes hot chocolate in the winter?

Write a wh-question on the blank line below.

2. when

_____

Examples: When does Mary drink hot chocolate? When does Bill like to drink lemonade?

Now, write your own wh-question on the line below.

3. what

_____

BEGIN PART II. Read the following short paragraphs. Write 5 appropriate wh-questions for each paragraph.

A. Last summer Mike and Pat traveled to Hawaii for a vacation. Mike tried surfing and hurt his arm. Pat went snorkeling and saw beautiful fish in the water.

1. who

_____

2. when

_____

3. where

_____

4. what

_____

5. who

_____

B. Bess and Toby are having a barbecue in the park. this afternoon They invited all of their friends. Toby is cooking the hamburgers, and Bess is serving the cake and ice cream.

1. when

_____

2. where

_____

3. who

_____

4. what

_____

5. what

_____

Name _____ School _____

Age _____ Grade ____ Teacher_____ ____

POST-TEST

Read the questions carefully. You should finish the test within 30 minutes. If you finish early, please review your answers very carefully.

Part I

Read each group of four (4) questions. Only one of the questions is correct. Choose and mark the correct question with an **X**.

Example 1. Choose the correct question.

A. What did see you at the movies last night?
B. What you saw at the movies last night?
C. What did you see at the movies last night?
D. What was you see at the movies last night?

"C" is the correct question:
What did you see at the movies last night?
The correct letter, "C," is marked below.

A. What did see you at the movies last night?
B. What you saw at the movies last night?
X What did you see at the movies last night?
D. What was you see at the movies last night?

Example 2. Choose the correct question.

A. Where does play soccer Bill?
B. Where does Bill play soccer ?
C. Where Bill plays soccer?
D. Where is Bill play soccer?

"B" is the correct question:
Where does Bill play soccer ?
Now, mark the correct letter, "B."

A. Where does play soccer Bill?
B. Where does Bill play soccer ?
C. Where Bill plays soccer?
D. Where is Bill play soccer?

BEGIN PART I. For each test item, mark the correct question with an **X**.

1. A. Who is hungry for cookies are from the bakery?
B. Who hungry for cookies from the bakery?
C. Who is hungry for cookies from the bakery?
D. Who are hungry for cookies from the bakery?

2. A. Who cleans the kitchen every weekend at home?
B. Who the kitchen cleans at home every weekend
C. Who cleans the kitchen at home every weekend?
D. Who the kitchen at home every weekend?

3. A. When is Joe Montana is coming to CSDF?
B. When is Joe Montana coming to CSDF?
C. When is coming Joe Montana to CSDF?
D. When Joe Montana comes to CSDF?

4. A. What is cooking on the kitchen stove?
B. What does cooking on the kitchen stove?
C. What is cooking is on the kitchen stove?
D. Is cooking what on the kitchen stove?

5. A. When Bonnie see the bear at Yosemite?
B. When did Bonnie see the bear at Yosemite?
C. When Bonnie did see the bear at Yosemite?
D. Did Bonnie see the bear at Yosemite when?

6. A. What does bring Ed to school every Monday?
B. What does Ed bring to school every Monday?
C. What does Ed bring every Monday to school?
D. What is Ed bring to school every Monday?

7. A. When Les and Lily are going to New York?
B. When are Les and Lily go to New York?
C. When is Les and Lily going to New York?
D. When are Les and Lily going to New York?

8. A. What Eve and Sally want for breakfast?
B. What do Eve and Sally want for breakfast?
C. What does Eve and Sally want for breakfast?
D. What do Eve and Sally they want for breakfast?

9. A. Who saw the Superbowl on TV last month?
B. Who the Superbowl saw on TV last month?
C. Who saw the Superbowl last month on TV?
D. Who was saw the Superbowl on TV last month?

10. A. What did Bill play at the party last night?
B. Did Bill what play at the party last night?
C. What does Bill play at the party last night?
D. What Bill did play at the party last night?

11. A. Where Tom and Jim were hiking last Sunday?
B. Where are Tom and Jim hiking last Sunday?
C. Where were Tom and Jim hiking last Sunday?
D. Where Tom and Jim hiking where last Sunday?

12. A. When is the Halloween party at school?
B. When the Halloween party is at school?
C. Is the Halloween party at school when?
D. When the Halloween party at school?

13. A. Who did exercising in the gym yesterday?
B. Who is exercising in the gym yesterday?
C. Who was exercise in the gym yesterday?
D. Who was exercising in the gym yesterday?

14. A. What did Andy cook yesterday for dinner?
B. What did Andy cook what for dinner yesterday?
C. Andy did cook what for dinner yesterday?
D. What did Andy cook for dinner yesterday?

15. A. Where are Dan and Jane their bikes fixing?
B. Where is Dan and Jane fixing their bikes?
C. Where are Dan and Jane fixing their bikes?
D. Where Dan and Jane fixing their bikes?

16. A. What was played at the theater last Saturday?
B. What was playing at the theater last Saturday?
C. What did playing at the theater last Saturday?
D. What is playing at the theater last Saturday?

17. A. Who was painted the fence in the yard last weekend?
B. Was painting the fence who in the yard last weekend?
C. Who was painting the fence in the yard last weekend?
D. Who the fence was painting in the yard last weekend?

18. A. When Emily works at Burger King?
B. When does Emily works at Burger King?
C. Emily does work at Burger King when?
D. When does Emily work at Burger King?

19. A. Where Bud have a flat tire last week?
B. Where did Bud have a flat tire last week?
C. Where does Bud have a flat tire last week?
D. Where did Bud did have a flat tire last week?

20. A. What the students are reading in the library?
B. What is the students reading in the library?
C. What the students reading in the library?
D. What are the students reading in the library?

21. A. Mom and Dad's vacation when was?
B. When did Mom and Dad's vacation?
C. When was Mom and Dad's vacation?
D. When Mom and Dad's vacation was?

22. A. Who is dancing in the show today?
B. Is dancing in the show today who?
C. Who is dancing in the show is today?
D. Who is dancing who in the show today?

23. A. Where the cats catching mice at night?
B. Where do the cats they catch mice at night?
C. Where do the cats catch mice at night?
D. Where do the cats do catch mice at night?

24. A. What Nan was typing in class yesterday?
B. What did Nan typing in class yesterday?
C. What was Nan type in class yesterday?
D. What was Nan typing in class yesterday?

25. A. Who showed slides at the party last week?
B. Who is showed slides at the party last week?
C. Who showed slides last week at the party?
D. Showed slides at the party last week who?

Name _____

Part II

Directions: Part II contains short paragraphs. First, read each paragraph. Then, write wh-questions that fit each paragraph. Look at the example to see what kinds of questions to write.

Example:

Bill likes to drink lemonade in hot weather. Mary likes soda in the summer and hot chocolate in the winter.

1. who

Who likes hot chocolate in the winter?

Write a wh-question on the blank line below.

2. when

_____

Examples: When does Mary drink hot chocolate? When does Bill like to drink lemonade?

Now, write your own wh-question on the line below.

3. what

_____

BEGIN PART II. Read the following short paragraphs. Write 5 appropriate wh-questions for each paragraph.

A. Charlie Brown is happy. He passed his spelling test at school yesterday. Charlie is sitting on the front step and eating an ice cream cone. Snoopy is eating an ice cream cone too.

1. who

_____

2. when

_____

3. where

_____

4. what

_____

5. who

_____

B. Lisa and Bob love animals. Lisa has a hamster, and Bob has a white mouse. Beth went to the pet store yesterday and bought a big white rabbit. She named the rabbit "Harvey."

1. when

_____

2. where

_____

3. who

_____

4. what

_____

5. what

_____

6. who

_____