TEACHING SELECTED MICROCOMPUTER SKILLS TO RETARDED STUDENTS VIA PICTURE PROMPTS

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Five retarded students were taught to use picture prompts to help them access and terminate a microcomputer program. Training was provided within a multiple baseline format. Posttesting (picture prompts without feedback), and a return to baseline were later conducted for both the training program and an untrained (generalization) program. The results indicate that the program was successful in teaching the microcomputer skills to the students. In addition, all students were able to maintain their skills over a 7-day interval in which they did not have access to the microcomputer.

DESCRIPTORS: microcomputer skills, picture prompts, maintenance

The number of microcomputers in special education classrooms is predicted to grow to 150,000 by the 1985-1986 school year (Blaschke, 1982). Microcomputers provide one-to-one instruction, immediate feedback, and reinforcement (Bennett, 1982); however, students must become "computer literate." Although microcomputers may be available to mentally retarded students, the potential uses of this equipment are limited by the training needs of the students.

Picture prompts have facilitated the acquisition and generalization of complex skills by mentally retarded persons (Johnson & Cuvo, 1981; Thinesen & Bryan, 1981; Wacker & Berg, 1983). Participants in these studies were trained to imitate the performance depicted by a picture representing each step of a complex task, and they were then trained to use the pictures independently to complete the task. In addition, students trained to use picture prompts have generalized their use of pictures across tasks.

We gratefully acknowledge the assistance of the two special education teachers, Sue Fett and Lorraine Bowen, who participated in this investigation. Detailed task analyses of the two computer programs used in this study are available from Alan R. Frank.

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The major advantage of teaching mentally retarded students to use picture prompts in operating microcomputers is the reduction or elimination of teacher supervision if students generalize their skills, thereby allowing students more opportunities to use the software programs.

We evaluated a training program using picture prompts to teach selected microcomputer skills to retarded students. We did not measure the effectiveness of microcomputer programs to accomplish the goals listed in the program manuals.

METHOD

Students and Setting

The five participants met criteria for placement in a classroom for mildly mentally retarded children. Tom was 13 years, 6 months old with an IQ (WISC-R) of 70. Linda, 11 years, 7 months of age, had an IQ of 69. May was 11 years, 5 months old with an IQ of 63. Carla, 11 years, 3 months old, had an IQ of 61. Sheila was 11 years, 11 months old with an IQ of 61. The classroom teacher reported that Tom, Linda, and Carla were reading at beginning second-grade level and Sheila was reading at first-grade, second-semester level. By random assignment, Tom and Linda were in Experimental Group 1, and May, Carla, and Sheila comprised Experimental Group 2.

The study took place in a special education classroom of an elementary school. An Apple IIe microcomputer with one disk drive and monitor were situated on a table in a corner facing the classroom. Approximately 1 m from the microcomputer was a shelf on which were placed five microcomputer programs, including the two used in this study (*Customized Flash Spelling*, 1981; and *Clock*, 1983).

Tasks and Materials

Target tasks. The students were trained to complete all steps required to start (25 steps for the spelling program, 16 for the clock program) and terminate (7 steps for each of the two programs) a microcomputer program. The start-up phase of a program included getting the correct microcomputer program from the shelf, turning on the equipment, and selecting appropriate files or options within the program. The ending phase of a program involved shutting off the equipment and returning the microcomputer program to the shelf. These ending steps were the same for both programs.

For students in Experimental Group 1, the *Customized Flash Spelling* program served as the training task, and the *Clock* program was the generalization task. The training and generalization tasks were reversed for the students in Experimental Group 2.

Picture prompts. The prompts consisted of drawings on 21.5-cm × 27.5-cm pages, with 1–3 pictures per page. The picture prompts for each microcomputer program were bound into separate books. The spelling program book had 32 pictures (one for each step); the clock program book had 23 pictures.

In each picture, a green arrow or mark indicated an action to be completed by the student. For example, an upward pointing arrow on the picture of a disk drive with the door closed prompted the student to open the door. Red arrows or marks required the student only to observe. For example, a red mark on the picture of a disk drive “in use” light prompted the student to wait until the drive light went out before going on to the next picture prompt.

Design and Procedure

A multiple baseline across students with sequential withdrawal (Rusch & Kazdin, 1981) design was used. For each condition, a session involved recording a student's responses during the start-up and ending phases of a program. Each student's score per session was the percentage of steps correctly completed during the two phases.

Baseline 1. Baseline was completed on both microcomputer programs. Students were instructed to start the computer, complete the drill, then turn off the computer. Students were given a worksheet to do and were removed from view of the computer in any of three instances: (a) if they stated that they could not do the task, (b) if they were able to complete some steps of the task but could not reach the drill activity, or (c) if it appeared that they were damaging the disk or any of the equipment (e.g., bending a disk or attempting to remove a disk while the disk drive light was on). While the student completed the worksheet, the trainer advanced the program to the beginning of the drill, then brought the student back to the computer, and provided a demonstration of how to do the activity. The student was given 2–4 practice problems to complete (not scored), then was instructed to turn the equipment off and put the materials away. A response was recorded as correct for every step of the start-up and ending phases of the program completed by the student without assistance. Students did not have to complete the steps in the same order as listed in the task analysis, except where necessary for the program to operate properly.

Training 1. Training was conducted on only one of the programs for each student. During training 1, students were given a picture book and told to describe the behavior depicted in each picture. A response was scored correct if the student was able to describe the behavior shown in the picture without trainer assistance. Training 1 was conducted to determine if the pictures adequately depicted the behavior to be performed by the student. The trainer praised students' correct responses. When a student responded incorrectly, the trainer described the picture, then asked the student to describe the next picture. Training 1 con-

tinued until a student described the behavior depicted in each picture independently during one session.

Training 2. During training 2, students were given the picture book and instructed to use the pictures to complete the task. A response was scored correct if the student completed the step depicted by a picture without trainer assistance. Verbal correction (as in training 1) or praise was provided after each response. To proceed to posttest 1, the student needed to complete all start-up and ending steps correctly without trainer assistance during two out of three consecutive sessions (with no session falling below 90% accuracy).

Posttest 1. Posttest 1 was similar to training 2, except that the students' responses were not corrected or praised. Posttesting was conducted on both programs (training and generalization).

Training 3. For students who did not complete the generalization program with 100% accuracy during posttest 1 on two consecutive sessions, training 3 was implemented (this occurred only for the spelling program). The student was given the picture book, told to start the program, but stopped after the 10th step. These responses were not recorded. The trainer then manually demonstrated the next three steps (the shift key operations), because these caused students the most difficulty. Following the demonstration, the trainer turned off the equipment, returned the program to the shelf, then instructed the student to do all the steps using the picture book. Responses completed without trainer assistance were praised; incorrect responses were corrected. Training 3 was repeated until the student achieved 100% accuracy on the start-up and ending steps for one session.

Posttest 2. Posttest 2 was the same as posttest 1; students were given picture books and instructed to follow the pictures. No feedback was given.

Baseline 2. Baseline 2 conditions were identical to baseline 1 conditions. No feedback was given and no picture books were used.

Posttest 3. Posttest 3 was exactly the same as posttest 2. The students were provided with the picture books and instructed to use the pictures to guide their performance.

Follow-up. Students had access to a microcom-

puter about once per week, given the number of students per microcomputer (the equipment was shared with another class). Therefore, follow-up testing was conducted on both programs 7 days after the last posttest. During follow-up sessions, students were given no feedback, but the experimenter instructed the students to use the picture book to guide their performance. These instructions were given because they resemble the procedure teachers would follow during independent work time in classroom settings (i.e., a student would be handed the appropriate picture book and instructed to use it to complete the assigned task). A response was scored as correct if the student independently initiated and completed a step without trainer assistance.

Reliability

All reliability data were collected by the experimenters and trained university students. During each reliability probe, the experimenter and observer independently and simultaneously recorded each response (occurrence) made by a student during a session. Nonoccurrences were not scored. An agreement occurred when both the experimenter and observer recorded that the response of a student was performed either correctly or incorrectly; a disagreement occurred when a student's response was not scored the same by the experimenter and observer. Reliability (interrater agreement) was calculated by taking the number of agreements divided by the number of agreements plus disagreements and multiplying the number by 100. The interrater agreement during all reliability probes in the investigation (33% of all 186 sessions) averaged 98.8%, and ranged from 83% to 100%.

RESULTS

The percentages of steps completed correctly by the students in both experimental groups are presented in Figures 1 and 2. During baseline 1, minimal if any improvement occurred across sessions. During training 1 and 2, all students showed immediate improvement on the training task and learned to perform the steps with no errors in 13 sessions (range = 8 to 13 sessions).

Figure 1. Percentage of steps completed correctly by students in Experimental Group 1.

During posttest 1, both students in Experimental Group 1 completed correctly 97% of the steps on the training program steps during the first session, then improved to 100% accuracy. On the generalization task, Linda performed errorlessly, and Tom completed correctly 87% of the steps for the generalization program during the first session and 100% of the steps during the next two sessions. All three students in Experimental Group 2 performed the training task errorlessly for two consecutive sessions, but all three experienced diffi-

culty in using the shift key on the generalization program.

Training 3 was conducted for Experimental Group 2 on the generalization task. The students required a maximum of three training sessions to reach criterion and continued to perform errorlessly on both the training and generalization tasks during posttest 2 (with the exception of one session when Carla completed 96% of the training steps correctly).

During baseline 2 (no picture book), the per-

Figure 2. Percentage of steps completed correctly by students in Experimental Group 2.

formance of Linda (Experimental Group 1) remained stable on the generalization task and improved from 59% to 100% accuracy on the training task. Tom demonstrated increased accuracy on the training task across sessions within Baseline 2, and decreased accuracy on the generalization task during this condition. One student in Experimental

Group 2 (Carla) continued to complete both the training and generalization tasks with at least 90% accuracy. The remaining two students in Experimental Group 2 were able to complete the training task correctly for two consecutive sessions, but dropped below 60% accuracy on the generalization task. When the pictures were again available to

guide performance, all students performed errorlessly (posttest 2 for Experimental Group 1 and posttest 3 for Experimental Group 2).

During follow-up, four students maintained errorless performance on both programs. The remaining student, May, performed errorlessly on the training task, and completed the generalization task with 91% accuracy.

DISCUSSION

The results of this study indicate that the training program was effective in producing acquisition, generalization, and maintenance (1 week) of microcomputer skills. Picture prompts appeared to be particularly necessary for the maintenance of these skills. Although training students to operate microcomputers without picture prompts might seem desirable in terms of independence, other factors should be considered. For example, in the clock program, several levels of difficulty are available: telling time at different intervals (hour, half hour), and typing digits to represent the time shown on a clock face versus moving the hands to match the time shown in digits. As a student progresses from one level of difficulty to the next, the teacher can change one or two of the prompts in the picture book to achieve the appropriate instruction for a given student. Further, a student may use microcomputer programs in a number of subjects over time, with the teacher selecting higher levels of difficulty in programs as the student reaches criteria at lower levels. It seems more efficient to communicate these periodic changes to students with picture prompts rather than with verbal explanations. For this reason, continued use of the picture books by all students may be necessary.

At the beginning of this investigation, the participants' teacher and a second special education teacher who shared the microcomputer expressed concern regarding the substantial amount of time their aide spent supervising students who were using the microcomputer. They cited the children's lack of understanding of directions and options at the beginning of programs as a significant problem. Therefore, the aide needed to be at the mi-

crocomputer to assist students in loading programs and choosing appropriate program options, and to help students complete drill activities. At the end of the investigation, the training materials and procedures were thoroughly explained and demonstrated for the teachers. Both agreed that use of picture prompt books could solve the problems just described and agreed that they would try these procedures with their students.

Several investigations (e.g., Wacker & Berg, 1983) have now demonstrated that picture prompts can be effective in training mentally retarded students to perform complex tasks. At least three issues with respect to the use of picture prompts need further evaluation. First, the relative effectiveness of picture prompts on acquisition, generalization, and maintenance of performance needs to be investigated. For example, picture prompts may have only minimal effects on the initial acquisition of behavior, but may be needed later for acceptable levels of maintenance. A second, but related issue, concerns the continued need for picture prompts following training. Wacker & Berg (1983) reported that picture prompts could be removed without fading following training. Other investigations (e.g., Wacker & Berg, *in press*) reported that picture prompts could not be removed without substantial decreases in performance. Finally, the generalized use of picture prompts across dissimilar tasks needs to be evaluated. For example, can students who are trained to use pictures on one task (e.g., computer setup) generalize their use of pictures on a second, dissimilar task (e.g., photocopying)? This type of research is needed to determine if picture prompts promote generalization of specific skills or generalized picture-following skills.

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- Received July 13, 1984
Final acceptance January 23, 1985