BEHAVIOR DEPARTMENT

Walter E. Fernald State School

Waverley, Massachusetts

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CONTENTS

FIGURES

TABLE

1.0 BEHAVIOR ANALYSIS AND DEVELOPMENT OF INSTRUCTIONAL PROGRAMS

This report summarizes our most recent analyses of laboratory data, and outlines the status of analytic work begun this year. We have continued to seek functional ways of describing behavior that could lend greater precision to habilitative procedures and thus could result in more effective endeavors for retarded people.

Because of reassignment of the Title I teaching positions to ward service, our habilitative work has shifted from the general-purpose classroom that had been supported for over six years by P.L. 89-313 funds and was used as an in-service teacher training facility by the institution. Our analytic work is now focusing on the specific content or skill areas considered basic to "normalization" and the community coping behaviors required for it.

1.1 Reinforcer studies

In previous years we described in detail a reinforcer hierarchy based on mid-median rates of laboratory participants (Barrett, 1971, 1973). Each participant's "favorite" consequence was considered to be that which produced his or her highest median response rate. Subgroups based on "favorite" consequences were shown to differ for the participants with moderate to borderline psychometric classifications as compared with those categorized as severely or profoundly retarded (Barrett, 1973).

This report 1) compares rate distributions of the two psychometrically categorized groups, the distributions being based on each individual's median rate of responding for his or her "favorite" consequence; 2) compares the groups with respect to their distributions of median rates for consequences arranged according to increasing overall rate-sustaining power; and 3) examines profiles that emerged for selected individual participants.

Procedures used in our clinical search for rate-sustaining consequences were described in last year's report (Barrett, 1973). Most important for the habilitative relevance of our findings is the fact that all data are based on session-to-session rates under conditions that remained constant for each individual until his or her day-to-day variability ceased to show trends. This approach is in marked contrast to the "try-this-one-day-try-something-else-tomorrow" approach, which fails to permit adequate reinforcer sampling (Ayllon and Azrin, 1968) and which neglects the prolonged adaptation time required when retarded people are exposed to novel stimuli (Barrett, 1973; Barrett and McCormack, 1973).

Psychometrically associated behavior rates. Last year we showed that our severely and profoundly retarded participants were nearly evenly distributed with respect to different categories of consequences that sustained each individual's highest median response rates (Barrett, 1973). In contrast, for the less retarded, a mixture of candy and pennies or candy and tokens sustained the highest rates of the majority. The difference in the way the two psychometrically defined groups distributed their highest median rates over different consequence categories was statistically significant.

Figure 1 shows how the highest median rates of psychometrically defined subjects are distributed across rate intervals. Both distributions are skewed toward the higher rates. However, in the low-rate intervals (0-39 responses/minute

and 40-79 responses/minute), the percentage of severely and profoundly retarded participants markedly exceeds that of the less retarded, while no severely and profoundly retarded participants appear in the highest rate intervals (200 responses/minute and higher). The mid-medians of 88.3/minute for the borderline to moderate group and 25.5/minute for the severe and profound group are significantly different ($p = .03$). The distributions of the two groups over rate intervals are also significantly different ($p = .002$).

Last year we compared rate distributions of the two psychometrically defined groups working at peak unremediated efficiency on our differentiation-discrimination apparatus with a standard reinforcer (candy plus pennies or candy plus tokens) (Barrett, 1973). Those distributions, also significantly different, were skewed much as are the rates for "favorite" reinforcers. Even when each individual is considered in terms of his or her "best" reinforcer, the response rates of severely and profoundly retarded persons, as a group, are significantly lower than those of the moderate to borderline group.

Group reinforcer hierarchies. To further summarize our findings on reinforcers, we selected consequences that had been available to comparable numbers of participants in both the moderate-borderline and severe-profound categories. We retained the rank of these consequences from least to most powerful rate-sustainers, as determined by overall group mid-median rates. The question was: Do the two psychometric groups differ with respect to their hierarchies?

Figure 2 shows how the psychometrically categorized participants are distributed with respect to their highest median response rates for consequences that are arranged, from left to right, according to the increasing mid-median rates of the total subject group. The overall group-determined hierarchy, in order of increasing rate-sustaining power, is:

1. Recorded music, available continuously if the person maintains a rate of at least 80/minute on a plunger.

2. The audio channel of commercial television, available continuously if the person maintains his or her most stable plunger rate ($\underline{x}$), while the video channel is "free" (noncontingent).

3. Five-second episodes of recorded music, produced by every tenth plunger operation.

4. Five-second presentations of colored slides, produced by every tenth plunger operation.

5. The video channel of commercial television, available continuously if the person maintains his or her most stable plunger rate ($\underline{x}$), while the audio channel is "free" (noncontingent).

6. A candy, penny or token produced by every tenth plunger operation. (At the end of each session, pennies and tokens could be exchanged for coins to operate a soft drink vending machine.)

This hierarchy holds up for both of the psychometrically defined groups. A noteworthy finding—one that we have repeatedly found as we have reanalyzed our data with additional subjects—is that auditory consequences appear to be consistently less powerful rate-sustainers than visual consequences.

FIGURE 1

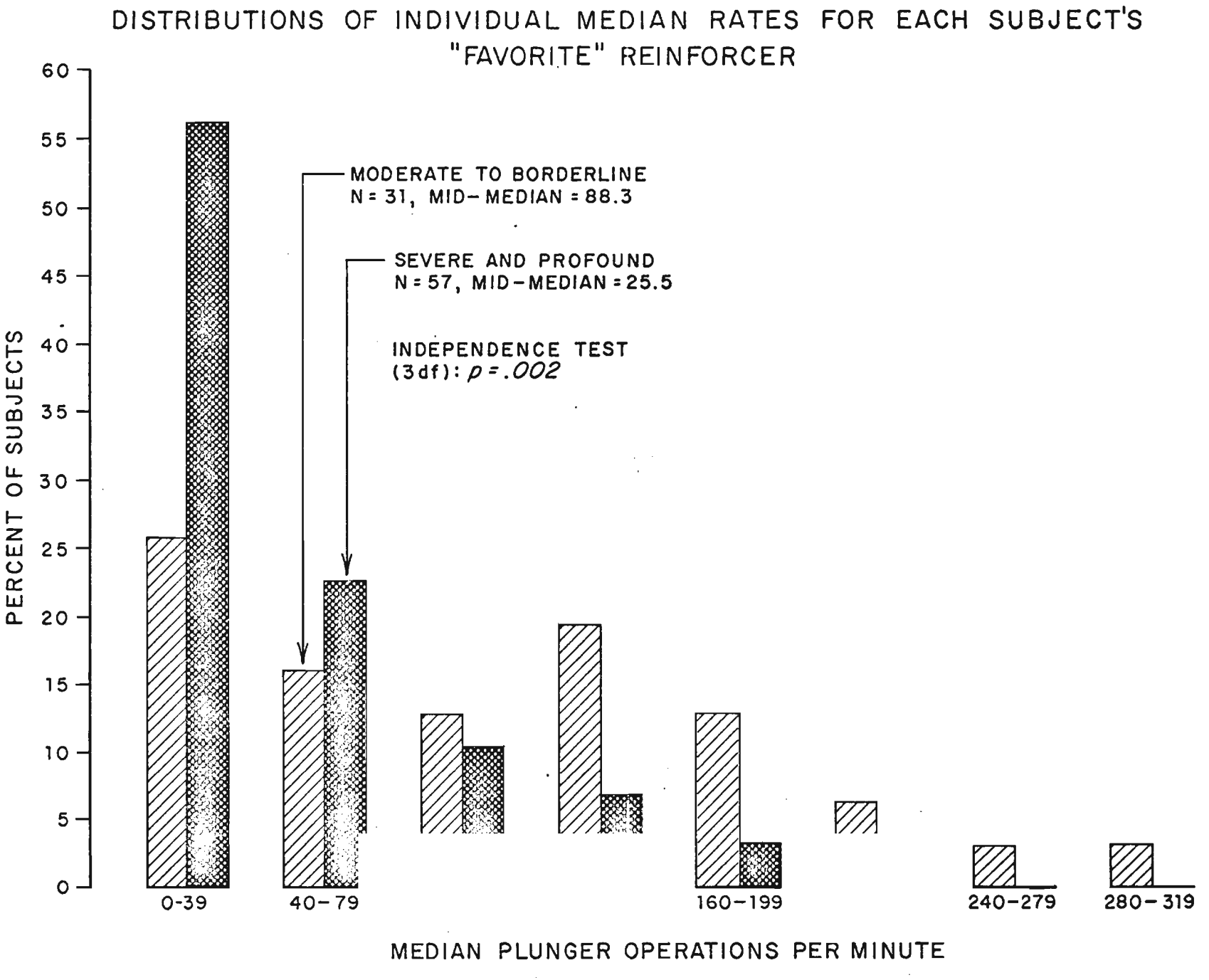
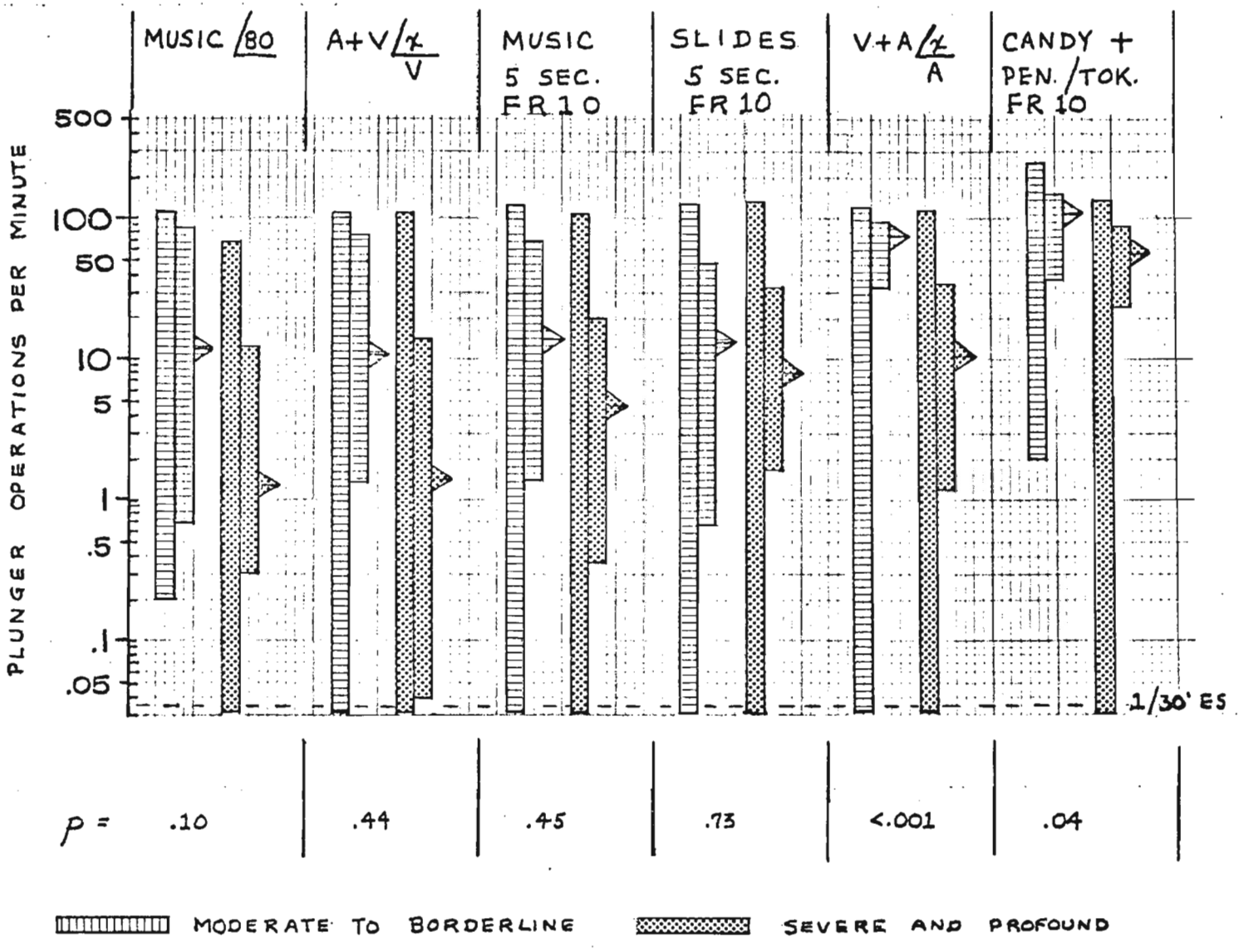

DISTRIBUTIONS OF INDIVIDUAL MEDIAN RATES FOR EACH SUBJECT'S "FAVORITE" REINFORCER
MODERATE TO BORDERLINE
N = 31, MID-MEDIAN = 88.3
SEVERE AND PROFOUND
N = 57, MID-MEDIAN = 25.5
INDEPENDENCE TEST
(3df): p = .002
PERCENT OF SUBJECTS
60
55
50
45
40
35
30
25
20
15
10
5
0
0-39
40-79
160-199
240-279
280-319
MEDIAN PLUNGER OPERATIONS PER MINUTE

FIGURE 2

DISTRIBUTIONS OF HIGHEST MEDIAN RATES OF PSYCHOMETRICALLY CLASSIFIED SUBJECTS WORKING FOR DIFFERENT CONSEQUENCES (RANKED BY MID-MEDIANS OF COMBINED GROUPS)



Within each consequence category, the mid-median rate of the moderate-borderline group consistently exceeds that of the severe-profound group. Two of the six comparisons are statistically significant with respect to the differences in mid-medians: that for video with free audio ($p < .001$) and that for candy plus pennies or tokens ($p = .04$).

Individual profiles showing marked selectivity. Group-determined hierarchies may be useful for selecting the consequences most likely to sustain behavior in the greatest number of retarded people. However, a glance at the very wide ranges of individual highest median rates (Fig. 2) shows that there are great individual differences.

In order to provide potentially useful prognostic information—information that could make training endeavors more precisely individualized and therefore more effective, we examined individual consequence profiles of median response rates for indications of selectivity (selective consequence effectiveness). With one exception, we chose only those participants who had opportunities to work regularly for at least four different types of consequences (N=65). Their ages ranged from 46 months to 216 months (mean = 134.0). Age at admission ranged from 0.2 month to 124 months (mean = 46.4). Duration of residency ranged from 0.03 month to 169 months (mean = 87.7). Twenty-six were female and 39 were male.

An individual might show consequence selectivity in two ways: 1) by working at an unusually high rate for one consequence relative to his or her rates for other consequences and/or 2) by emitting very little behavior to obtain a given consequence relative to his or her rates for other consequences. We grouped individuals with respect to their "peak" and their "weak" rates for given consequences, irrespective of how the consequences were scheduled.

Criteria for "peak" and "weak" rate selectivity were influenced by the marked skewness toward the high end of the "favorite" consequence-sustained rates shown in Figure 1. Because relatively few participants emit high median response rates, we defined a "peak" rate selective person as one whose highest median rate for a given consequence was at least 1.5 times higher than his next highest median rate. Since the highest median rates of the majority of participants are massed toward the low end of the rate distribution, our criterion for a "weak" rate selector was far more stringent. For a person to be categorized as "weak" rate selective, his lowest median rate for a given consequence had to be at least five times lower than his median rate for his next-to-lowest rate sustaining consequence.

Peak-rate selective profiles (N=32) appear in Figures 3, 4, and 5. Seven (10.8% of the 65 participants) are candy-selective, three (4.6%) are music-selective, six (9.2%) emitted "peak" median rates for colored slides, five (7.7%) "peaked" for television, and eleven (16.9%) "peaked" for candy plus tokens or pennies.

These 32 "peak" rate selective people constitute 49.2% of the 65 participants. They include 44.1% of the psychometrically "untestable" participants, 46.7% of the moderate-borderline participants, and 50.0% of the severe-profound group.

Weak-rate selective profiles (N=11) appear in Figure 6. Note that candy plus pennies or tokens did not produce selectively low rates in any of our participants. For one person (RC51), candy was not effective; for one other (RC52), television was not effective. Five persons demonstrated that music was not an effective rate-sustainer for them. Four showed that slides were ineffective in sustaining their behavior. "Weak" rate selective people make up 8.8% of the

"untestable"group, 26.7% of the moderate-borderline group, and 14.0% of the severe-profound group.

Selectivity shown by a combination of "peak" and "weak" rates also emerged. Seven of our eleven "weak" rate selective people (63.6%) also appeared as "peak" rate selective. They are indicated by "P" above their profiles, and they constitute 10.8% of the total group of 65. Selectivity, defined by the dual criteria, is not related to psychometric category, to sex, or to psychometric "testability." While the mean age of consequence-selective people (126.3 months) is significantly lower ($p = .02$) than that of the non-selective people (151.3 months), the two groups do not differ significantly with respect to their mean ages at admission or their mean durations of residency.

Selectivity and rate. Of the 65 people who had extended opportunities to work for a variety of consequences, only 10 failed to emit enough behavior to show whether or not they were selective according to our criteria. As shown earlier, the majority of our participants demonstrate relatively low median response rates for their "favorite" (most effective) consequences (see Fig. 1). Even though consequences were individualized according to each person's highest median rate, this measure does not adequately dehomogenize individuals in the lower rate ranges.

However, if we examine individual mid-median rates derived from each individual's profile of consequence-sustained median rates, we find that the group whose mid-median rates fall below the combined group mid-median contains a greater proportion of selective than non-selective subjects ($p < .001$). Furthermore, the mid-median rate of the selective group is significantly lower than that of the non-selective group ($.01 < p < .02$).

Thus it appears that, in addition to cross-cutting psychometric categories, age at admission, and duration of institutional residency, consequence selectivity derived from repeated opportunities to work for different types of consequences yields clear-cut individual profiles that are especially critical in revealing the individuality of low-rate responders. It is these people who pose the greatest problems in locating long-term-effective reinforcers. By permitting them to show us what consequences sustain their best behavior rates, we have another prescriptively applicable dimension that dehomogenizes this population.

Consequence selectivity and psychometric "testability." Of the 65 participants with repeated opportunities to earn a variety of consequences, 34 (52.3%) were "untestable" by conventional psychometric methods. Yet, with repeated regular opportunities, 25 (73.5%) of these "untestable" people emitted enough behavior to show distinct consequence profiles. Of the 25, 17 (68%) are selective according to one or both of our criteria: 48% are peak-rate selective; 8% are weak-rate selective; 12% demonstrate both types of selectivity. These strikingly different individual profiles of directly measured behavior furnish yet another indication that, by judiciously programming consequences that are available in most homes and classrooms, we can obtain useful and directly comparable measurements from people whose behavior is not within the range of commonly used psychometric methods.

References for Section 1.1

Ayllon, T., and Azrin, N.H. The Token Economy: A Motivational System for Therapy and Rehabilitation. New York: Appleton-Century-Crofts, 1968.

FIGURE

CONSEQUENCE EFFECTIVENESS PROFILES
OF SELECTIVE PEAK-RATE SUBJECTS

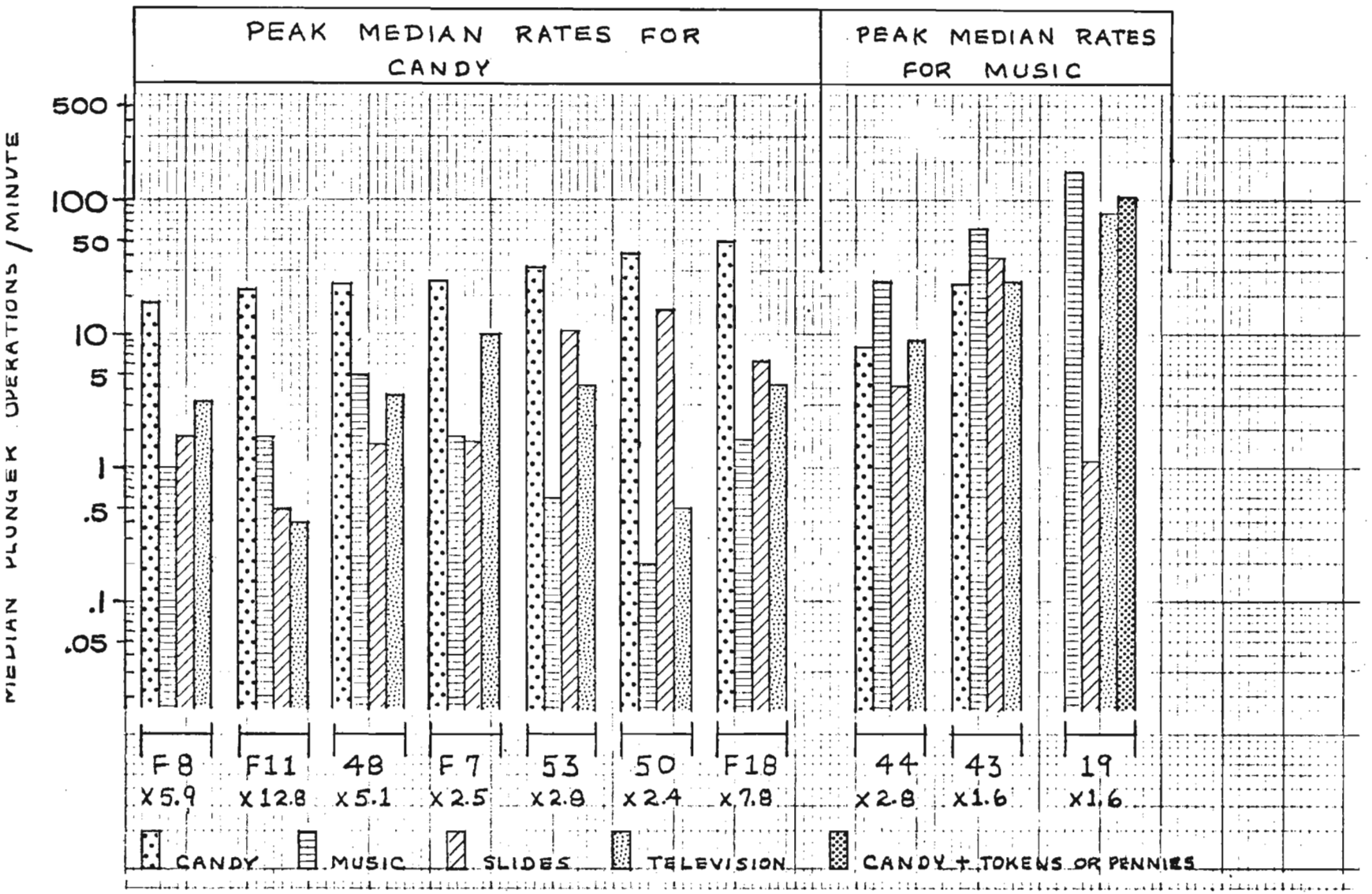


FIGURE 4

CONSEQUENCE EFFECTIVENESS PROFILES
OF SELECTIVE PEAK-RATE SUBJECTS

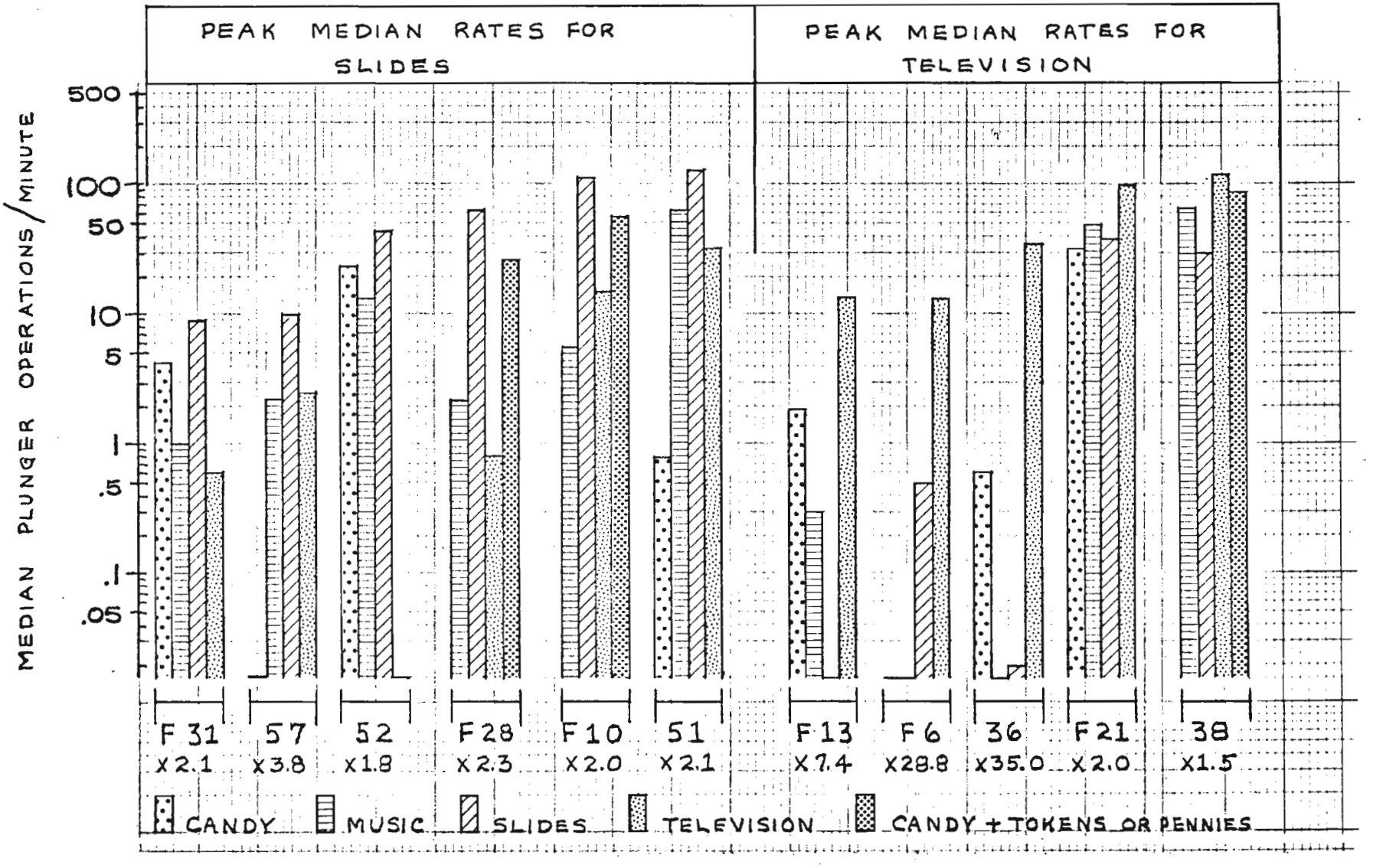


FIGURE 5

CONSEQUENCE EFFECTIVENESS PROFILES
OF SELECTIVE PEAK-RATE SUBJECTS

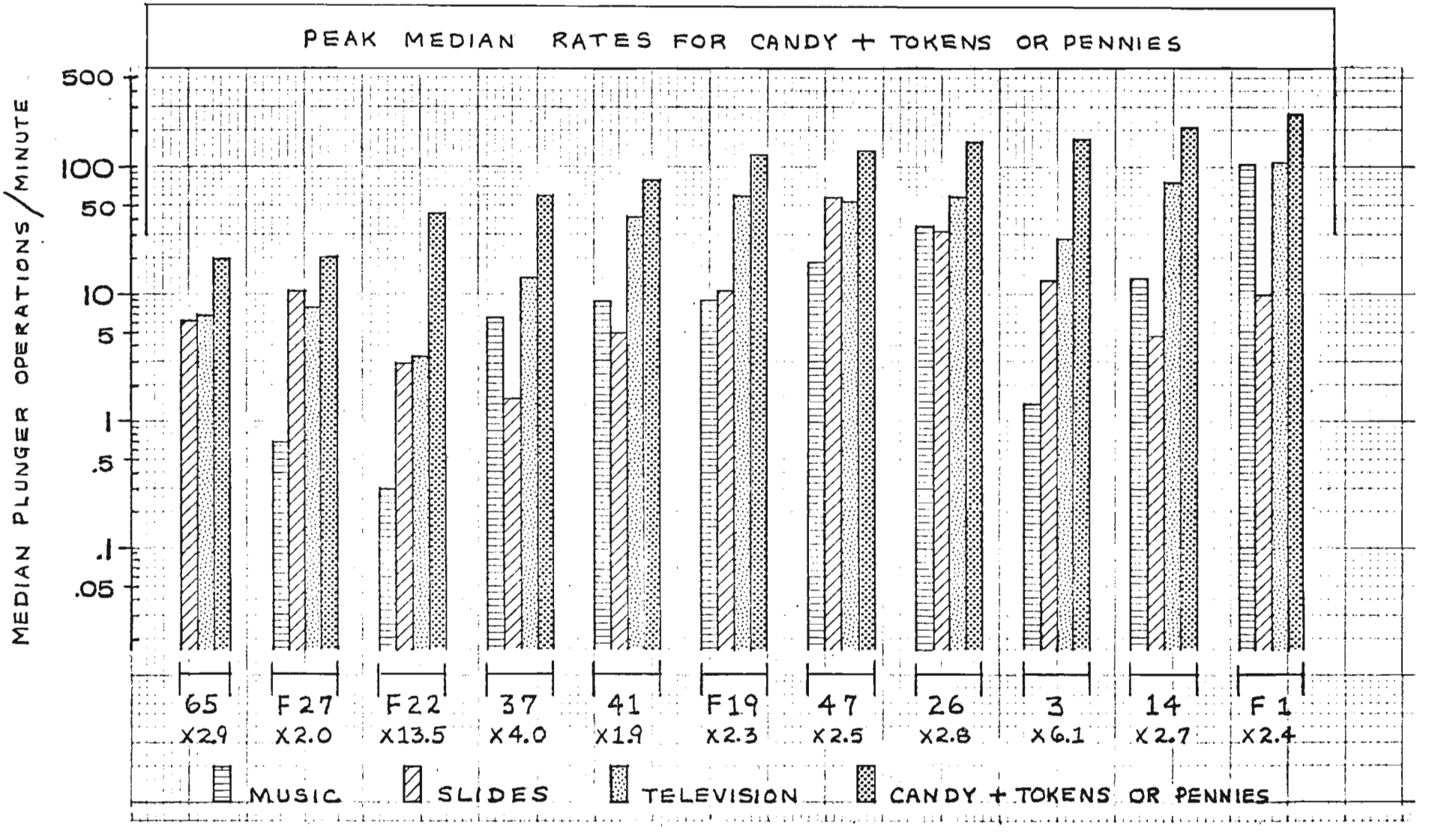
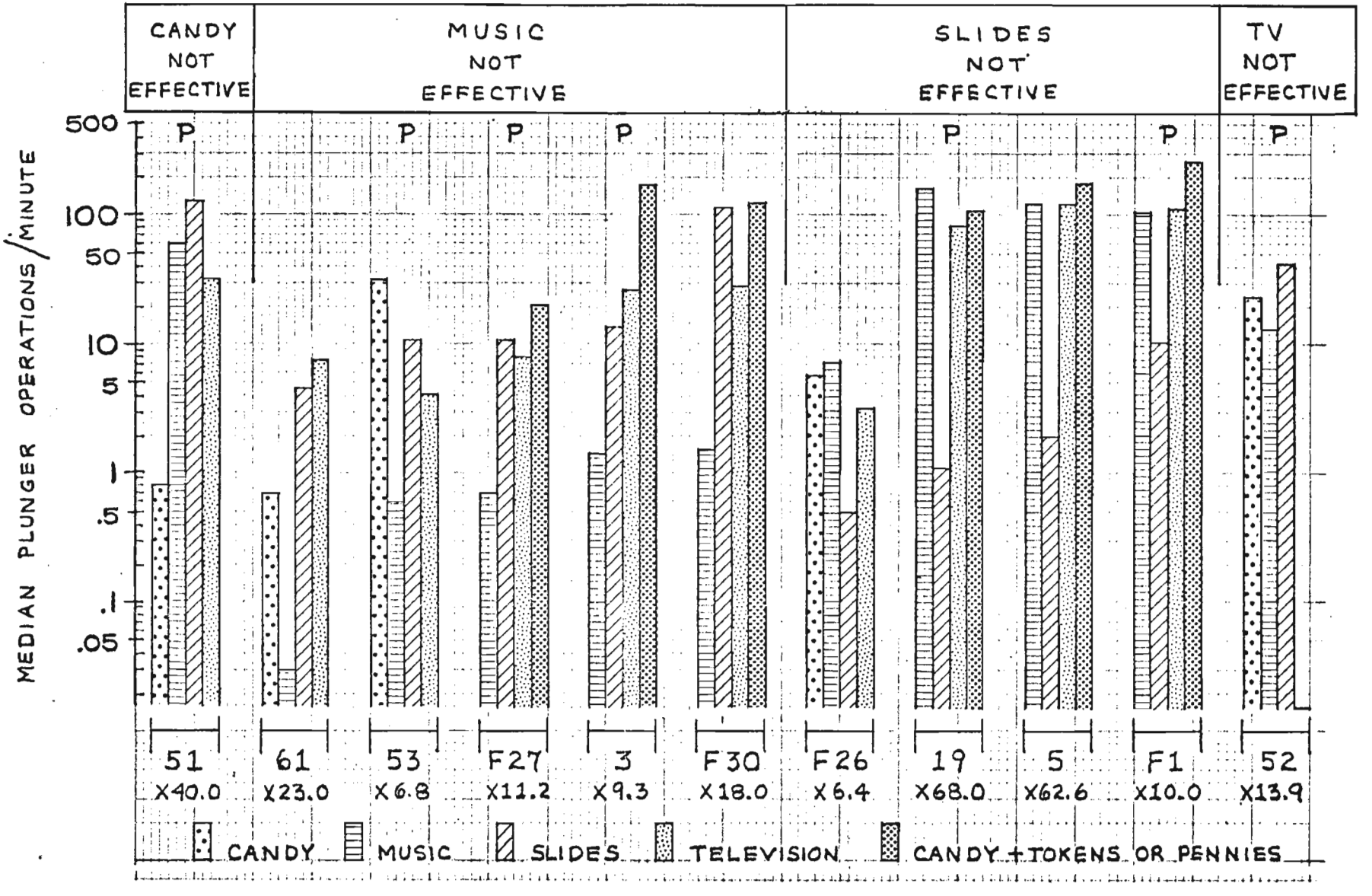


FIGURE 6

CONSEQUENCE EFFECTIVENESS PROFILES
OF SELECTIVE WEAK-RATE SUBJECTS



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Barrett, B.H. Annual Report, 1 July 1972 - 30 June 1973. Behavior Department, Walter E. Fernald State School, Waltham, Mass., 1973.

Barrett, B.H., and McCormack, J.E., Jr. Varied-teacher tutorials: A tactic for generating credible behavior in severely retarded children. Mental Retardation, 1973, 11(6), 14-19.

1.2 Acquisition subgroups at successive stages of emergence

Last year, in our analysis of acquisition subgroups, we presented a comparison of psychometrically categorized residents in terms of the amount of acquisition shown by individuals who had been permitted time enough to reach their maximally efficient performance patterns in a differentially reinforcing environment (Barrett, 1973). Although there was no significant difference between the psychometrically categorized subjects in their distributions among acquisition subgroups, the severely and profoundly retarded subjects took significantly longer to show their maximally efficient levels.

In the light of new laws mandating periodic assessment of every resident's progress and the current DMH interest in developing a standardized instrument for this purpose, we continue to analyze our data for their relevance to this most worthwhile endeavor.

Accordingly, we examined more closely the progressive changes in distributions among acquisition states of the 40 subjects who eventually reached States 1 to 4, as shown in Figure 1 of last year's report (Barrett, 1973). (For functional description of acquisition states, see Lindsley, 1962; Barrett, 1965, 1973.) The 40 subjects were 62.5% of our total group (N=64). Eighteen (45%) are classified as Levels III-V ("borderline" to "moderate" retardation). Twenty-two (55%) are classified as Levels I and II ("severe" and "profound" retardation) (Heber, 1959). We asked whether their distributions among acquisition states, after repeated measurements of their progress, were related to their psychometric classification. We also wished to know what percentage of those who showed some form of acquisition would have been misclassified as "non-learners" had we set an arbitrary time limit rather than a time period functionally defined by each subject's best acquisition state.

Figure 7 shows how the 40 participants distributed themselves after the number of repeated opportunities necessary for each to show his or her maximal acquisition. Criteria for placement in an acquisition subgroup were the same as described last year: four consecutive sessions at "best" performance. Time intervals are shown as blocks of five sessions. Distributions among acquisition states for two psychometrically defined groups are shown for each block. The percentages from distribution to distribution are cumulative. For example, a person who showed his or her "best" four consecutive sessions within the first block of five sessions was assigned the acquisition state described by his or her pattern of responding, and that person remains in his or her assigned subgroup throughout subsequent distributions. Thus, for any block of sessions, the distributions represent the percentage of individuals who, by that time, had been sifted into the various acquisition subgroups.

In no case are the distributions within session blocks significantly different for the two psychometrically defined groups. That is, with repeated opportunities to attain their best level of acquisition, the severely and profoundly retarded participants were distributed similarly to the borderline to moderately retarded participants. This is consistent with the comparison of final state distributions for all subjects shown in Figure 1 of last year's report (Barrett, 1973). Degree of retardation, as defined by psychometric scores, appears to have little bearing on how much a person learns in (how efficiently he or she adapts to) our standard differentially reinforcing environment. This finding supports a growing body of evidence indicating that predictions about retarded people's competency limits based on their current IQ or SQ are shaky at best and probably should never be made (see Gold, 1973).

The data in Figure 7 have even more important implications for design of reliable assessment methods. Last year we stressed the importance of assessing behavior change in response to clearly defined, replicatable contingencies and the necessity of obtaining repeated samples of behavior to determine a person's current behavior repertoire, especially in the case of the more severely retarded, who take significantly longer than the less retarded to show their current skills. Fig. 7 amplifies this point by showing developmental stages in the emergence of four acquisition subgroups (States 1-4). By comparing successive distributions, we can trace the shifts of psychometrically categorized participants from transitional states to their best performance. Since we excluded from this analysis the 37.5% of our total group who showed no acquisition without special training, no one shows up in States 5 or 6 of the last distribution (sessions 36-40). The reason the additional state appears without a final-state number is that in this particular experimental design, acquisition of only the differentiation of the plungers or only the discrimination of the light positions is a developmental stage in the emergence of more enduring behavior patterns (Barrett, 1965).

Since it is common practice to set arbitrary limits on the number of behavior samples obtained for most assessment purposes (usually only one!), Table 1 summarizes the data from Figure 7 in terms of the percent of subjects showing any stage of acquisition after an arbitary but specified number of repeated one-hour opportunities in a differentially reinforcing situation. The columns labeled "% False Negatives" indicate the percentage of subjects who might have been misclassified as "non-learners" after an arbitrary number of sessions because their full performance efficiency had not yet emerged. If we had set a limit of five one-hour sessions, there would have been 28% false negatives in the total group, 11% among the less retarded and 41% among the more severely retarded. After 25 hours there would have been no false negatives among the less retarded but still 18% among the more severely retarded. After 40 sessions, all subjects showed some form of acquisition. Fifty-five percent of the Level III-V participants and 36.4% of the Level I-II participants achieved State 1 (full acquisition); 44.4% of the Level III-V people and 63.6% of the Level I-II people were identified as showing one of the specific deficits (States 2-4) requiring special training.

Some may regard these data as resulting from a repeated "trial-and-error" procedure with intermittent reinforcement and without any added remedial or prosthetic variables, and they may register astonishment that anyone showed acquisition. The more psychometrically minded may think of repeated testing to sort people into groups that are homogeneous with respect to degree of acquisition or type of deficit. The experimental analysts of free operant behavior may see in these data the development of baseline performances prior to experimentation (the clinical analog would be a kind of "waiting list cure"). We hope that

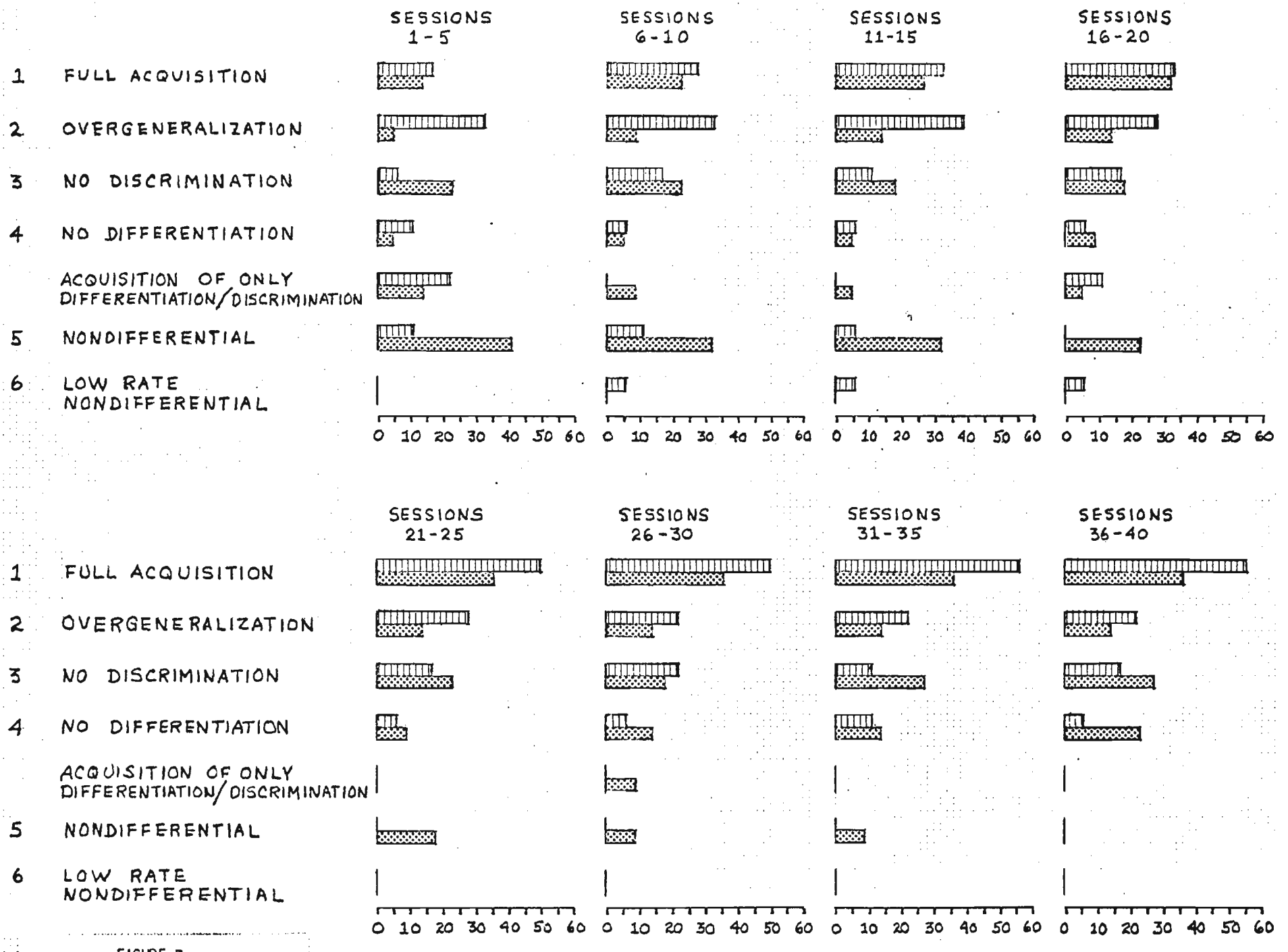

FIGURE 7

STATUS OF ACQUISITION SUBGROUPS AT SUCCESSIVE STAGES OF EMERGENCE

Table 1

CHANGES IN ACQUISITION STATUS SHOWN BY REPEATED MEASURES

	Total Group		Levels III-V		Levels I-II	
After	% showing any Acquisition	% False Negatives	% showing any Acquisition	% False Negatives	% showing any Acquisition	% False Negatives
5 sessions	72	28	89	11	59	41
10 sessions	75	25	83	17	68	32
15 sessions	77	23	89	11	68	32
20 sessions	85	15	94	6	77	23
25 sessions	90	10	100	0	82	18
30 sessions	95	5	100	0	91	9
35 sessions	95	5	100	0	91	9
40 sessions	100	0	100	0	100	0

professionals who make decisions about retarded people's adaptability to or acquisition in novel environments will see their own analogs in these data and, at the very least, pause to ask whether, indeed, they have permitted retarded persons the repeated opportunities they need to show what they can do and what specific problems they need help with.

Our own observations of our classroom pupils and our OJT trainees--as well as the results of repeated psychometric testing, even without added reinforcement (Ayllon and Kelly, 1972; Edlund, 1972)--are corroborated not only by our laboratory data but also by the reports of other investigators who find that, regardless of whether they are living at home or in an institution (Bricker, 1972), retarded persons require a minimum adaptation period of at least six weeks before anything resembling reliable samples of current skills can be obtained.

Yet, in the absence of any normative information on the time required for maximal adaptation to varieties of situations (to a workshop situation, to a new ward environment, etc.), pronouncements are made and habilitative decisions are reached about individuals on the basis of an inadequate number of observations over an even less adequate period of time. At the very least, this practice creates artifacts in evaluating the effectiveness of training procedures. Most importantly, it increases the likelihood of failure of the very mission it seeks to accomplish: to maximize the opportunities and options for retarded persons to perform more normally.

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Barrett, B.H. Acquisition of operant differentiation and discrimination by institutionalized retarded children. American Journal of Orthopsychiatry, 1965, 35, 862-885.

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Lindsley, O.R. Operant conditioning methods in diagnosis. In J.H. Nodine and J.H. Moyer (Eds.) Psychosomatic Medicine: The First Hahnemann Symposium. Philadelphia: Lea & Febiger, 1962. Pp. 41-54.

1.3 Follow-up survey

Over the years, we have studied many Fernald residents. Informal observations—in classroom, ward, waiting room, and other settings—have suggested that our laboratory measures of individual behavior patterns are related to the way these individuals behave outside the controlled environment of the laboratory. It now seems appropriate to find out what has become of residents who have cheerfully donated their behavior for study. Accordingly, we have devised a questionnaire that should yield specific enough information about each resident or former resident to enable us to look for correlates of laboratory behavior patterns.

The questionnaire will summarize each laboratory participant's history with respect to educational and psychological testing, medical diagnoses, chronic medications, physical defects or disabilities, maladaptive behaviors, admissions and discharges, residential locations, participation in educational programs, participation in vocational programs, current residency, current employment and progress, current educational and/or vocational training status and progress, current self-help status and progress. The survey contains separate sections for 1) former residents, 2) persons who live off the grounds but are not yet discharged, and 3) current residents on the grounds.

In addition to providing information about the predictive value of laboratory studies, this instrument in and of itself may be of value to other members of the institution staff who are following the progress of residents, both at the

institution and in community programs.

1.4 Automated assessment and instruction

On the basis of data from some of our former classroom pupils, we have revised the programming of our newest apparatus. We now have the capability for assessment and instruction in color discrimination, color matching, and auditory color-word comprehension. Stimulus materials for numeral discrimination and matching and for discrimination and matching of colored shapes are now ready to be photographed.

1.5 Preliminary studies preparatory to investigation of concurrent performances

In preparation for his studies of concurrent performances in retarded children (section 4.0), Carl Binder has been gaining experience in the kinds of behavior patterns shown in the laboratory by severely retarded children. Six Farrell Hall children, new to the lab, were exposed to some standard procedures for rate comparison and rate building. Five of the six demonstrated typical within-session and between-session variability, likely reflecting the confounding of variables in their daily living environment with the more controlled laboratory variables. One child began to demonstrate the steady-state behavior and schedule control shown in earlier laboratory studies of small animals (Ferster and Skinner, 1957). The patterns demonstrated by these children are pertinent to the design and assessment of the concurrent schedule situation Mr. Binder plans to use in his future study of "matching" performances.

Reference for Section 1.5

Ferster, C.B., and Skinner, B.F. Schedules of Reinforcement. New York: Appleton-Century-Crofts, 1957.

1.6 Sequence to teach receptive and expressive sight vocabulary

Shelley McNaughton prepared a task-analytic chart detailing procedures for 1) assessing entering behaviors and 2) determining areas of needed instruction in acquisition of sight vocabulary. The teaching sequence provides instruction for both verbal and nonverbal children. It begins with required pre-skills, such as sitting in a chair, visual tracking, and imitation, and covers the following processes: visual matching, receptive labeling and expressive labeling of both auditory and visual material, and finally receptive and expressive word comprehension.

The teaching sequence extends a program of Domnie and Bellamy (1972) by 1) providing more detailed analyses of tasks, arranged in seven basic teaching phases, and 2) adapting the methods for nonverbal as well as verbal students.

This program is ready for field testing, should the personnel be provided.

Reference for Section 1.6

Domnie, M., and Bellamy, T. A sequential procedure for teaching reading skills to trainable retarded students. In L. Brown and E. Sontag (Eds.) Toward the Development and Implementation of an Empirically Based Public

School Program for Trainable Mentally Retarded and Severely Emotionally Disturbed Students: Part II. Madison, Wisconsin: Madison Public Schools, Department of Specialized Educational Services, 1972. Pp. 122-141.

1.7 Sequence to teach printing

A similarly refined analysis of lower-case letter components forms the basis for a sequence which takes a child from prerequisite skills (sitting in a chair, visual tracking, and gross motor imitation), through visual discrimination of shapes, lines, and letters, receptive letter-labeling and expressive letter-labeling, and finally through tracing, copying, and writing letters in response to their spoken names.

A chart similar to that for sight vocabulary indicates the sequence to be followed, the phases that should be omitted for nonverbal students, and the points at which rate building should be achieved. A workbook for this program accompanies the description of teaching procedures.

This program is also ready for field testing, should the personnel be provided.

1.8 Diagnostic-prescriptive sequence to assess and teach word recognition

As part of an ongoing investigation into stimulus compounds and selective attention, Gene Buchman devised an errorless learning program to teach word recognition to retarded, mute students with severe attentional deficits. The program, which is still experimental and will undergo considerable further development, provides a tool for: a) teaching functional reading skills to students who would not otherwise acquire those skills, b) assessing the extent of attentional deficits and their relationship to impaired learning in these students, and c) possibly remediating the deficits.

The program draws on previous work by Barrett (1965) and Barrett and Lindsley (1962) on behavioral deficits; Zeaman (1973), Zeaman and House (1963), and House and Zeaman (1963) on stimulus compounds; Reynolds (1961), Ray (1969), Lovaas and Schreibman (1971), Lovaas, et al. (1971), and Touchette (1969) on selective attention; Terrace (1963a, 1963b), Sidman and Stoddard (1967), Stoddard and Sidman (1967, 1971) and Touchette (1968) on errorless learning; Sidman, Cresson, and Willson-Morris (1973) on reading comprehension; and Skinner (1968) and Brown (1973) on programmed instruction. Its immediate antecedents are the pre-reading and initial reading sequences developed by Shelley McNaughton in the Behavior Department last summer (see section 1.6).

The program teaches printed, lower-case, whole-word shapes as recognition units for sight-reading, deferring the much more difficult skills of letter recognition and coding until the student has acquired some reading proficiency.

The sequence of procedures for teaching word recognition, the cross-modal matching of auditory to printed words, is diagrammed in Figure 8. Auditory comprehension, matching auditory words to visual pictures or objects, is a prerequisite (entering behavior) for the program. Besides auditory comprehension, also called picture or object recognition, entering skills for the word recognition program are: gross form discrimination, color discrimination, size discrimination, and color intensity discrimination.

FIGURE 8

SEQUENCE OF PROCEDURES USED TO TEACH WORD RECOGNITION TO RETARDED STUDENTS

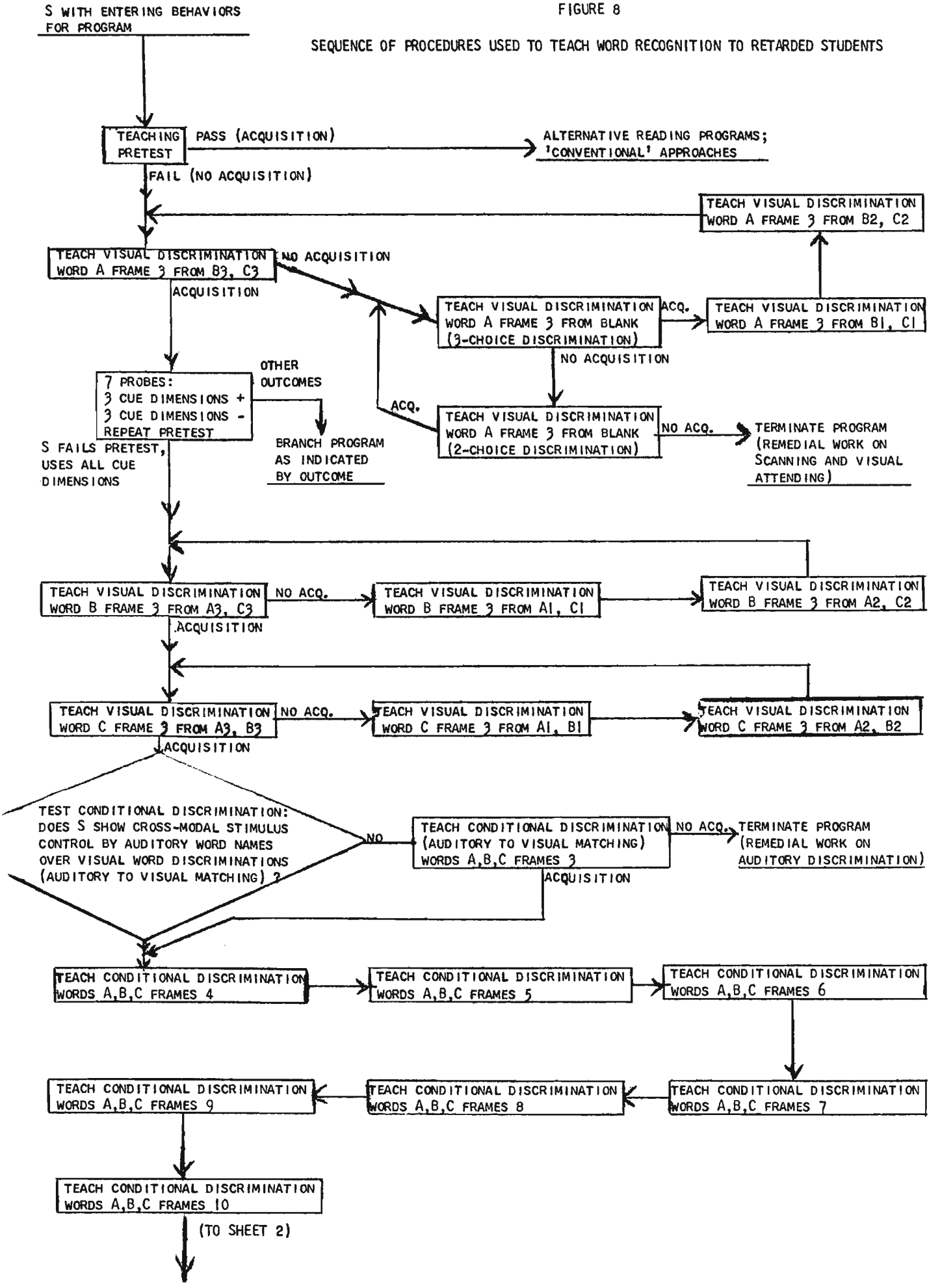
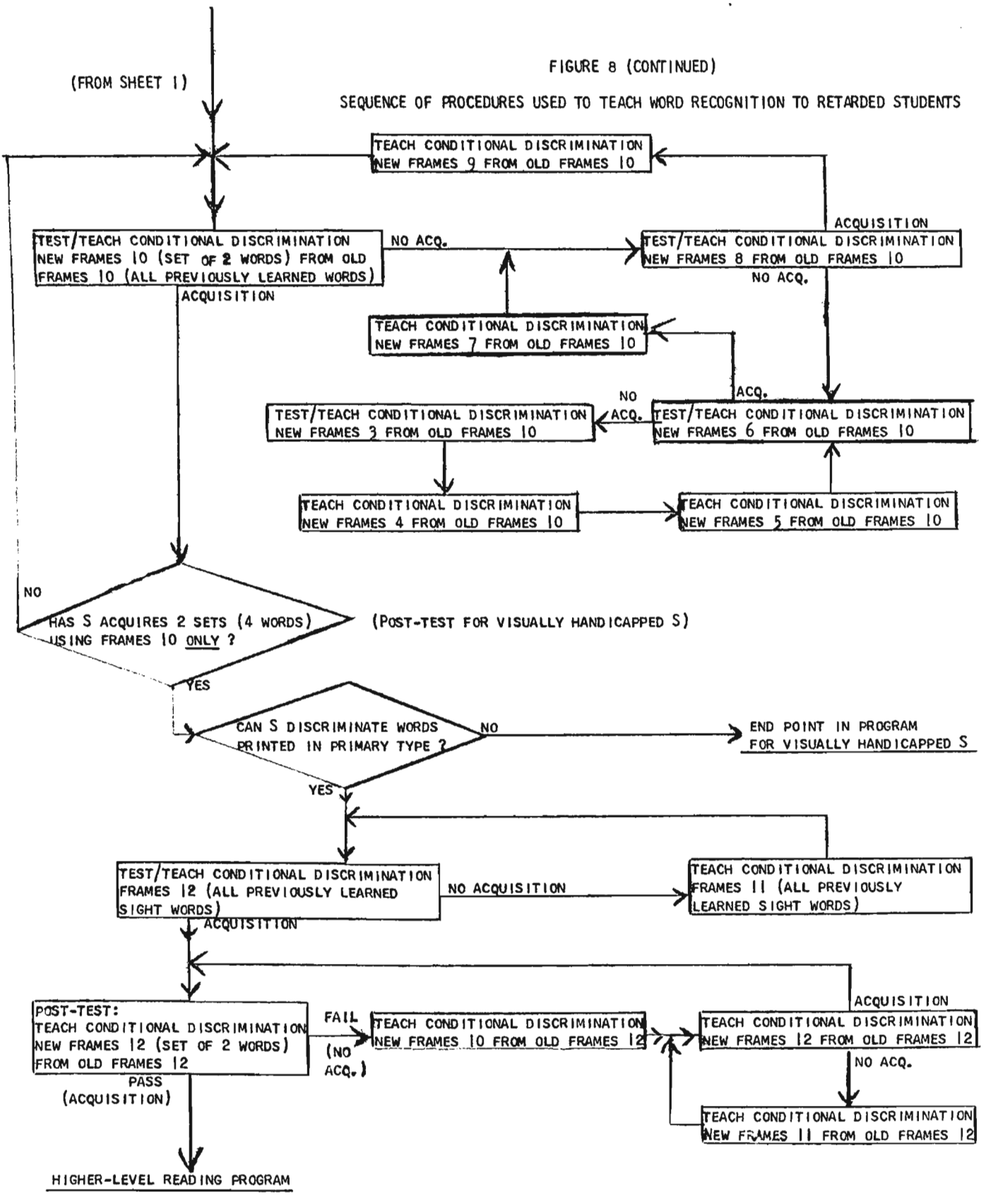


FIGURE 8 (CONTINUED)

SEQUENCE OF PROCEDURES USED TO TEACH WORD RECOGNITION TO RETARDED STUDENTS



FRAME CODES:

0: BLANK
1: BACKGROUND ONLY (+ SIZE)
2: BACKGROUND + COLOR + SIZE + FORM; INTENSITY FADING
3: BACKGROUND + COLOR + SIZE + FORM
4: HEAVY OUTLINE + COLOR + SIZE + FORM
5: LIGHT OUTLINE + COLOR + SIZE + FORM
6: COLOR + SIZE + FORM
7: COLOR + FORM; SIZE FADING
8: COLOR + FORM
9: FORM; COLOR FADING
10: FORM ONLY (12.7 MM. LETTER HEIGHT)
11: FORM ONLY (9.5 MM. LETTER HEIGHT)
12: FORM ONLY (6.35 MM. LETTER HEIGHT)

Each student is pretested for these skills, and taught if necessary with a Teaching Resources model 36-120 attribute set and an errorless distance-fading technique (Fig. 9) developed for these and other Behavior Department programs. The pretest also includes a series of teaching trials for the terminal skill using the distance-fading procedure alone. A student who shows acquisition during these trials is shunted onto an abbreviated word-recognition program that will be more efficient for him or her, or directly onto a commercial program.

Task analysis of word recognition yields two major behavioral objectives for the program: a) visual discrimination among whole-word shapes, and b) cross-modal stimulus control over this discrimination by the spoken names of the words.

Each of the dimensions, form, color, size, and color intensity, is relevant in the initial discrimination taught. (Form is enhanced by yellow background highlighting). The student is then tested, via a series of probes, for independent control of the discrimination by the positive (reinforced) value of each cue, and by all possible combinations of these stimuli, to identify both the necessary and the sufficient conditions to maintain performance.

The student overlearns the initial discrimination of each of three words in order to facilitate intradimensional shift training (Eimas, 1966; Shepp and Turrisi, 1969). When smooth performance of shifts of correct choice among the three words is established, the student is tested for cross-modal control of these visual discriminations by the auditory word names. If learning does not occur through simultaneous presentation of the auditory and visual stimuli, the student is taught to respond to the spoken words via the distance-fading procedure, with the auditory sample and the choice of S+ among the visual comparison stimuli randomized.

The program then branches, presenting each student with stimulus compounds comprising only the visual dimensions that have proved effective for the student, plus the spoken word names. The cues fade along each continuum sequentially, transferring control from more salient to less salient compounds. The stimuli converge to words differing only in shape (gross form) and auditory name.

Program materials are on 3 x 5 index cards, allowing new stimuli to be prepared during a teaching session, if needed. The program uses a three-choice discrimination paradigm in all phases, in order to maximize the probability of the student's adopting an approach-positive strategy, to minimize adventitious reinforcement of random or perseverative responding, and to develop the scanning skills that the student will need for more complex discriminations. A two-choice option is available as part of a correction sequence in the early phases of the program for students who must be taught the three-choice performance.

A combination correction and back-up procedure is used for errors. Since errors are rare with this teaching format, the effects of the correction procedure are difficult to assess, but if the student shows emotional reactions or if the frequency of errors rises, the correction procedure is eliminated while the back-up procedure is retained.

When a student has learned the initial three words to criterion (10 errorless trials on each word, randomly arranged), he is taught sets of two new words at a time. The third choice in the position-randomized, three-choice stimulus array is always one of the words already learned, and every time the student correctly selects it, another of that student's "old" words replaces it. With

sets of three new words at a time, some students learn to discriminate within but not between sets. Teaching one new word at a time is simply less efficient than the present method. The frequency of "old" word correct choices is adjusted, if necessary, to reduce tension should the student's response latencies show that the new discriminations are difficult or to keep the density of correct choices and reinforcement high if errors have occurred. In this way, the student learns explicitly to discriminate each new word from each old word, and continually practices all of the words already learned.

Each time a new word set is introduced, the student is tested to determine which cues are still needed for acquisition. Only those that are necessary are retained, and each is faded within each set. The student has completed the program when he or she can learn new words errorlessly with no added cues, using the distance-fading procedure alone. If, in addition, new words can be acquired with a single trial of distance-fading, the student is likely to be able to continue learning with the trial-and-error methods of conventional teaching.

Token reinforcement is used with all students to ensure that the length of teaching sessions is limited by the student's attention span and not by satiation. The student is pretrained, if necessary, using a Behavior Department token training program which Mr. Buchman also developed this year. The student learns new discriminations on continuous reinforcement (CRF), while those already learned are maintained on variable-ratio reinforcement to provide for durability of the behavior.

Preliminary data are available for eight students, five boys and three girls, 10 to 14 years old. Four are non-verbal, and four have some speech. (Verbal students are taught to repeat the word name upon choosing a word card to facilitate the emergence of oral reading; some non-verbal students have learned to use the word cards to express their wants.) Two of the verbal students are mildly retarded dyslexics who have failed to learn to read by conventional methods. One student is moderately retarded. Five are severely or profoundly retarded.

Probe data indicating the cue dimensions that each student used were ambiguous in some cases, but clear in others, as shown here:

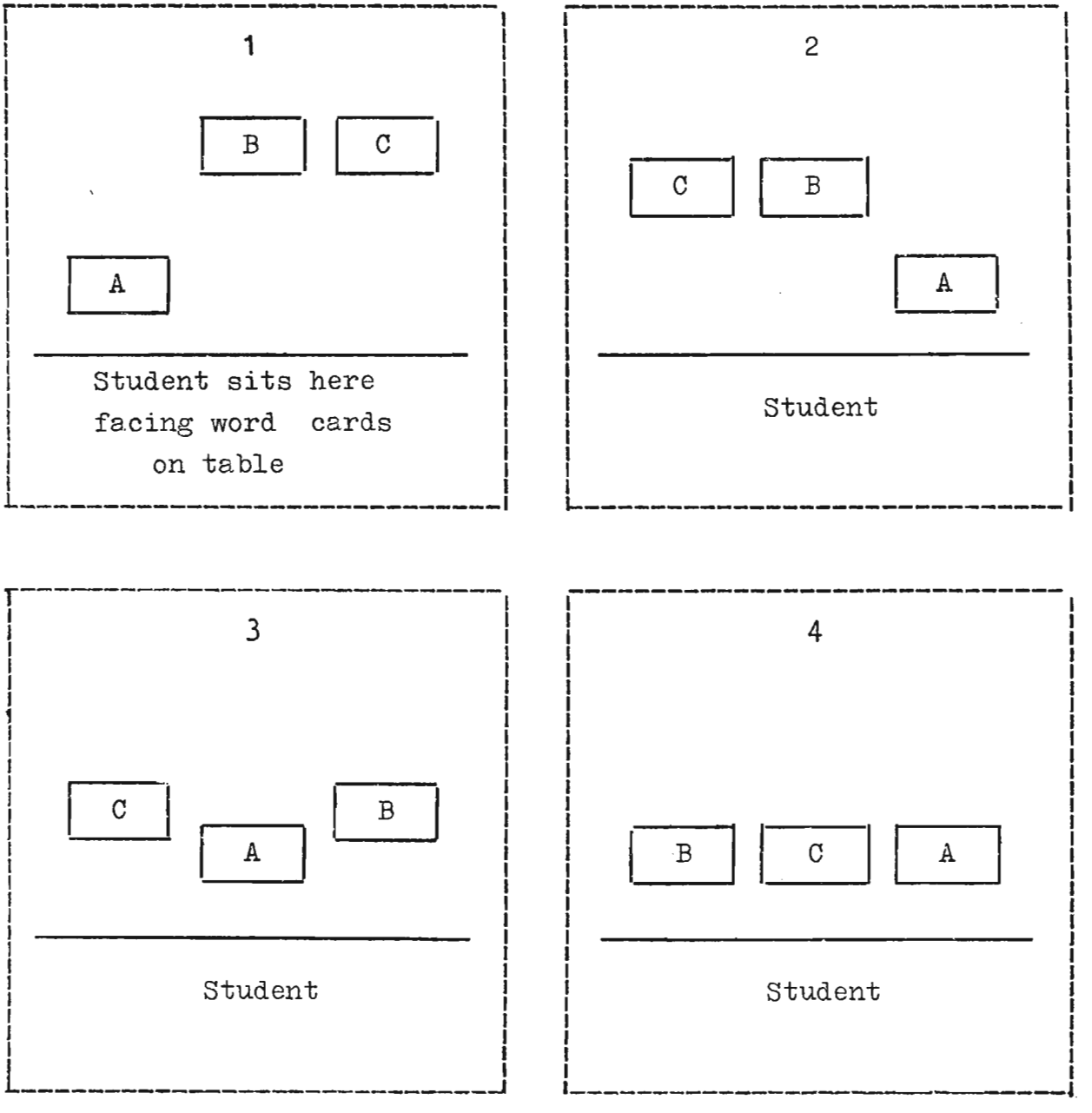
	STUDENTS							
CUE	P.O.	A.M	P.B.	G.B.	T.H.	L.G.	M.H.	R.B.
Shape (Background highlighting)	—	yes	no	—	?	?	yes	yes
Size	no	yes	yes	—	?	?	yes	—
Color	yes	—	yes	yes	?	?	yes	yes

FIGURE 9

DISTANCE-FADING PROCEDURE FOR TEACHING WORD-RECOGNITION

(MATCHING PRINTED WORD TO ITS SPOKEN SOUND)

THE CORRECT WORD (CARD A) IS ALWAYS PLACED NEAR THE STUDENT, WHILE THE INCORRECT WORDS (CARDS B AND C) ARE MOVED CLOSER TO THE STUDENT ON EACH TRIAL UNTIL, AS IN BLOCK 4, THE THREE CHOICES ARE LINED UP.



The blank cells indicate performances with partial cues which did not differ significantly from either no-cue or full-cue performance (Fisher's exact probability test).

Students T.H. and L.G. passed the pretest when it was repeated at the start of the probe trials. Since they had previously failed the pretest, it is unclear whether they learned the word-shape discriminations by transfer from the compound stimuli without fading, or whether the same number of trials with uncued stimuli and distance-fading alone would have sufficed for them. As a result of their performances the probe trials were relocated to a position immediately following the first compound discrimination taught, from their previous position further along in the sequence.

Figure 10 shows the complete performance of one student, P.O., in learning 51 words and 10 numerals. His anomolous, though still successful, performance on numeral recognition (sets 17 through 21) tends to confirm the hypothesis that symbols such as numerals and letters are more difficult for a retarded student to discriminate than are whole-word shapes. Part way through the program, P.O. was tested for and failed to show the ability to discriminate the individual letters of words which he had learned to read.

His errors on sets 2, 3, and 4 resulted from continuation prior to set 2 of a probe without color cues on a trial-and-error basis, to see what would happen. P.O. began to make errors on the words he had already learned as well as on the new words, indicating extinction of his attending to the remaining relevant dimensions of the stimuli. The pernicious effects of errors, including increased variability of the student's behavior and the generation and adventitious reinforcement of unprogrammed response strategies such as random selection and position perseveration, are clearly evident in the elevated error rates extending over three sets. (Color cues were later successfully eliminated for P.O. by fading.)

Future development of the word recognition program will focus on:

a) expanding the data base,

b) streamlining the present format, which uses 12 successive fading levels of stimuli, and investigating simultaneous rather than successive fading of cues,

c) investigating the relative efficiency of explicitly training students to use stimulus dimensions that their probes indicate they ignore in compounds, rather than eliminating these dimensions from the discriminations,

d) investigating the utility of a time-fading (delay) procedure developed by Touchette (1968) as an alternative to the distance-fading procedure,

e) Putting the program on slides and automating it via the touch-panels in our automated assessment and instructional apparatus (see section 1.4), to better control environmental variables, and increase the sensitivity of the probes and the resolution of the data.

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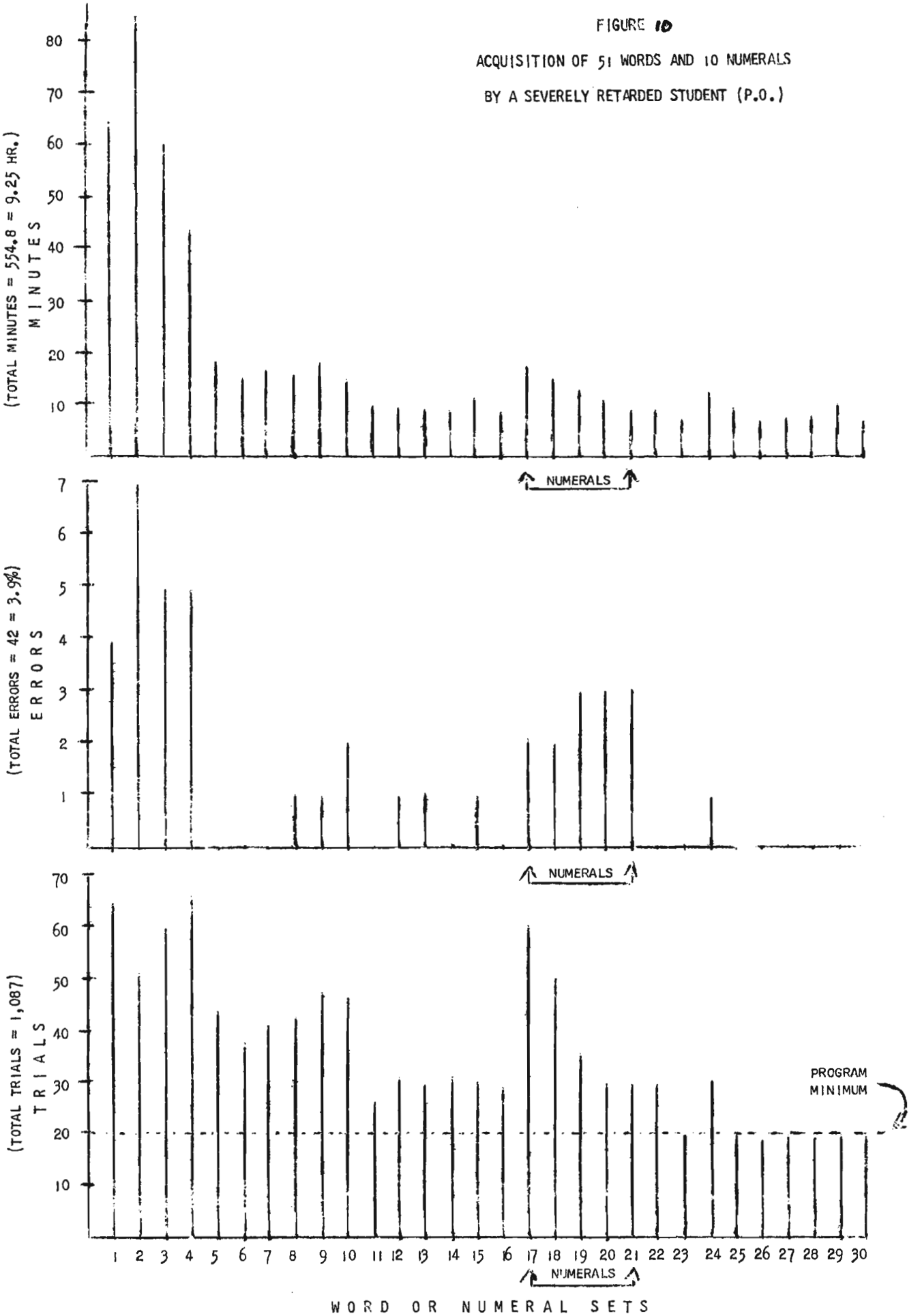
FIGURE 10

ACQUISITION OF 51 WORDS AND 10 NUMERALS

BY A SEVERELY RETARDED STUDENT (P.O.)



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1.9 Task-analytic assessment and programming of numerical skills

Curricula that teach skills necessary for independent functioning in the community have been developed and are in progress at Fernald. However, skills prerequisite to entering such programs are neither carefully sequenced nor systematically taught. For example, generalized numerical skills (such as using currency, phones, and public transportation, and telling time in a variety of situations) cannot be taught to people who lack basic numerical skills (such as rote counting, rational counting, and numeral naming). Thus, to ensure that Fernald residents receive full benefits from existing community-oriented training programs, basic numerical skills must be taught to as many as possible.

This past school year we received requests to teach basic numerical skills to fifty men. To this end, Deborah Pease has been investigating available instructional sequences for application with behaviorally retarded persons. Comprehensive academic programs validated with this population are lacking because effective methods of teaching academic skills to such people have only recently been systematically employed. Ms. Pease has delineated the necessary components of an effective numerical skills program for pupils with severe developmental disabilities. She has applied minimum rate criteria (Haughton, 1974) to numerical skill sequences validated for normal children (Resnick, Wang and Kaplan, 1973) and has begun to explore the efficacy of such a curriculum for our students.

To date, numerical and attribute skills of 11 men have been assessed with respect to the sequence of objectives shown in Figure 11. Ms. Pease has been tutoring four of the men for four to five hours weekly, and plans to assess other residents later this summer in order to begin teaching a larger number this fall.

The students in training have demonstrated varying degrees of progress on each type of task presented. Facilitation (i.e., "positive transfer") of one task by successful performance of the preceding tasks in Resnick, Wang, and Kaplan's (1973) sequence has not been apparent. Additional direct training appears nearly always necessary to meet each new objective. (Perhaps a requirement of a higher

rate of performance on each objective would yield greater transfer.)

Ms. Pease has also found that if the student is to be able to apply a skill with a variety of materials and in a variety of situations, generalization must be programmed. For example, numeral naming must be taught with a clock face, on informational and directional signs, and on price tags, as well as on flash cards. The number and variety of presentations of generalization tasks necessary to ensure a generalized skill depends on the individual and the type of task.

If students such as these are to acquire generalized skills, we must determine the most effective order in which to present new tasks to them and must develop more effective means of reducing the rate of errors and increasing the rate of correct responses. Only if these objectives are accomplished will we know that the skills we teach will indeed be useful for daily living.

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1.10 Behavior assessment inventory

Work on a criterion referenced, task-analytic behavior assessment inventory was begun last fall. The need for such an inventory is becoming more acute as legislation demands broadened educational options and improved service delivery for people previously excluded from publicly funded habilitative programs. Too, the growing number of published (and often validated) programs to teach self-help and domestic skills, as well as basic academic and vocational skills, makes it all the more important that we be able to assess the skill levels of our residents in specific enough terms to indicate their "readiness" for available instructional technology and their progress both during and after such training.

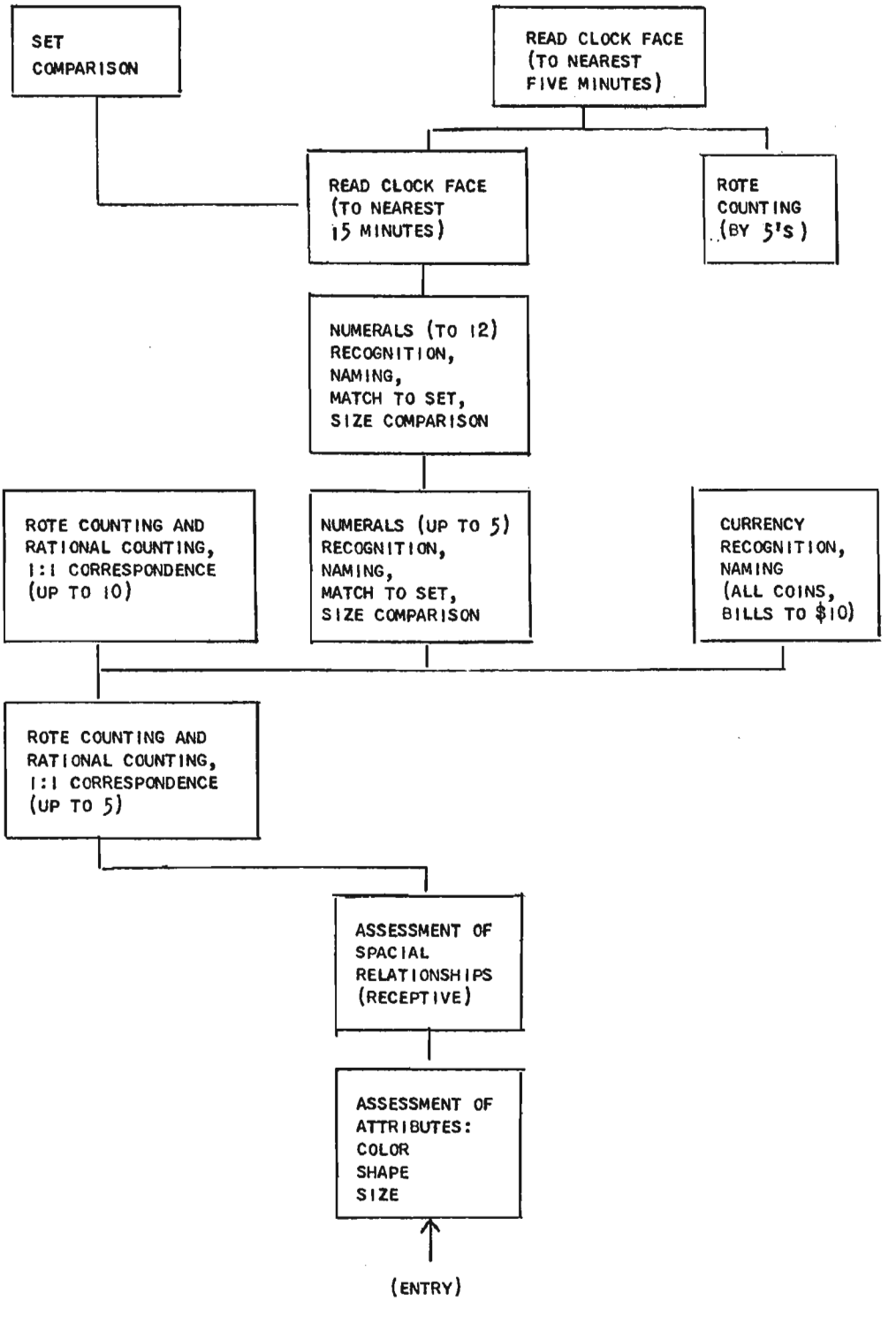
Much work is being done by others in refining scales for assessment of adaptive behaviors in areas of everyday self-maintenance. But little is being done in developing specific procedures for assessing preacademic and basic academic skills.

At present, in its preliminary form, our behavior assessment inventory covers these content areas: pre-reading, reading, writing, numerical skills, elementary arithmetic, use of money, time-telling, and temporal concepts. An individual's acquisition of each skill component can be indicated by selection of one of five nominal categories that describe his or her current status of performance and whether he or she has yet received instruction in the particular component.

Expansion and refinement of this inventory to key into selected published instructional programs will enable us to offer specific prescriptive information on each person assessed.

FIGURE 11

ASSESSMENT OF NUMERICAL SKILLS: SEQUENCE OF OBJECTIVES



1.11 Forms to aid in program dissemination and evaluation

Deborah Pease designed three forms to aid in the dissemination and evaluation of educational programs in use at Fernald. A pupil performance summary form requests specific and general information to help the teacher and teacher-supervisor evaluate the appropriateness of a given program for a student. A monthly program status form enables the Behavior Department to record and quickly review the current status of all programs in use. And a standard program cover sheet has been developed to encourage dissemination and ensure correct usage of institution programs. The cover sheet has seen much use in the Education Department, and we hope that other departments (e.g., physical therapy, occupational therapy, physical education, speech and hearing) will begin to use the program cover sheet to enlist the help of child care workers and others in continuing programs throughout the week.

2.0 TRAINING

In 1965 we established one of the country's first self-contained classrooms for severely and profoundly retarded, institutionalized children. Subsequently, we developed a workable system that provided--for student volunteers as well as professional teachers--initial training in the application of behaviorally-based instructional methods with such children. At the time, only one university in the country offered a training program for those who wished to teach the severely and profoundly retarded. Our program became nationally known as a demonstration that children who had spent their lives labeled "custodial" and "untrainable" could be taught basic elementary academic skills once assumed to be beyond their capabilities. In addition, we became a training resource for teachers, students, and MR workers from colleges and agencies throughout the Commonwealth (and from other states as well). As our offerings became better systematized (see section 1.0), requests for training and consultation increased, from both within and outside of the institution.

A total of 58 people were regular participants in our training programs: 34 residents, 8 Fernald teachers, 7 Fernald attendants, 6 student teachers, and 3 university students. Because our staff was cut in half due to reallocation of the Title I grant, we were unable to meet requests to train 78 residents and 6 attendants.

In response to the greatest demand we have ever experienced, and in spite of reduced staff, we further extended our training in the areas described below.

2.1 In-service training for Fernald staff

Weekly seminars for Farrell Hall staff

Carl Binder, with the assistance of Gene Buchman and Deborah Pease, conducted weekly seminars on behavior management and programmed instruction for eight Farrell Hall apartment coordinators and teachers, two attendants, and six student teachers. Participants were given a basic conceptual understanding of reinforcement, response differentiation and shaping, schedules of intermittent reinforcement, chaining, the reinforcement of alternative behaviors, various techniques for elimination of problem behaviors, and the need for quantitative records. Suggestions for reading were offered, and Behavior Department staff frequently met with the participants on an individual basis.

Mr. Binder prepared for the seminars a series of nine handouts entitled:

1. "Basic Assumptions and Some Ways of Measuring Behavior"
2. "An Initial Bibliography" and "Reinforcement"
3. "Teaching New Behaviors"
4. "Stimulus Control and Generalization"
5. "Fading and the Problem of Errors"
6. "Schedules of Intermittent Reinforcement"
7. "Means of Eliminating Problem Behaviors"
8. "Punishment"
9. "Some Case Studies in 'Spoiled Child' Behavior Problems"

Mr. Binder is also preparing a more detailed version of his handout, "Data Use in Teaching and Behavior Management," as a result of the seminars.

Program for training attendants to teach play skills to severely retarded residents

While improvements have been made in programming for severely and profoundly retarded residents, much of their time remains unstructured. They often occupy their free time with sterectyped or aggressive behaviors which preclude acceptance into alternative settings such as public schools or foster homes.

Because attendants have more contact with the children than other staff members, Deborah Pease designed a program to train custodially oriented attendants to teach severely and profoundly retarded residents how to play during their free time (Figure 12).

Play skills were chosen for a number of reasons. Studies have shown that playing with toys can be an alternative to stereotyped behaviors (Berkson and Mason, 1964; Luke, 1971; Flavell, 1973). Furthermore, both independent and cooperative play skills might come to be controlled by "natural" environmental stimuli (presence of toys and other children), so that play, once taught, might continue even in the absence of teachers. Social skills, in which these children are grossly deficient, could be taught in a cooperative play setting.

In this play skills project we intended to develop a simple system for training attendant staff to use and fade physical guidance and to consequate successive approximations of play skills while working with their charges. We hoped in this way to provide the attendants with some basic tools to generate other new behaviors in these children. We would explore the effectiveness of such a project in teaching a group of eight severely and profoundly retarded youngsters to play both independently and cooperatively with toys.

Four attendants were involved in this project. Three had been employed in custodial positions for 10 to 14 years and one for six months. The eight youngsters, four girls and four boys, resided on the ward staffed by these attendants. The children were from 10 to 17 years old. The Denver Developmental Screening Test yielded developmental levels below three years for all of them.

The project was introduced to the attendants as a chance for them to learn to teach and for their charges to learn to play. Ms. Pease discussed with them the children's current use of free time and how this might be improved by a play skills program.

Sessions, held three afternoons per week in the Behavior Department classroom, included a 30-minute play tutorial, followed by a 30-minute period of free play. Each attendant chose one to three children to teach each session. They were encouraged to work with different children, and they were assigned specific play skills to teach each session, depending on each child's entering skills and on the group size.

Using inexpensive, readily available toys, the attendants could teach a variety of play skills, all of which could be applied with different kinds of toys:

Toys	Skills
Trucks	Catching; pushing with wheels on floor to another child.
Pulltoys	Walking while pulling toy with wheels on floor.
Balls	Rolling; catching; tossing to another child.
Beanbags	Catching; passing to another child; tossing to another child; tossing into a truck.
Blocks	Stacking; pushing over; fitting together (blocks with grooves); taking turns with another child.

During tutorials, Ms. Pease modeled teaching of various skills through use and fading of physical guidance and reinforcement of successive approximations of each play skill. This was done within the context of the class, i.e., the attendants were not given explicit instructions to observe Ms. Pease, the teacher. Only two general teaching rules were stated: 1) Don't give a verbal cue more than two or three times, and 2) if verbal cues don't work, try something else. Suggestions were offered when requested by the attendants and when they appeared to be having a rough time. Procedures are diagrammed in Figure 12.

The attendants used food and praise to reinforce the children's playing. Initially a variety of foods (cereal, pudding, candy, peanut butter, cheese, and cold drinks) were offered. Once a child accepted some food, it was used as a possible reinforcer. If the child did not demonstrate increasing proficiency or appeared disinterested in playing, other foods were tried.

During the free play period, the attendants remained in the room to observe and reinforce appropriate use of toys and cooperative play. They did not verbally or visually prompt the children, nor did they physically guide them during this time. Only when children approached the attendants and initiated play activities did the attendants become involved. For example, if a child threw a ball to an attendant, the attendant would toss it back.

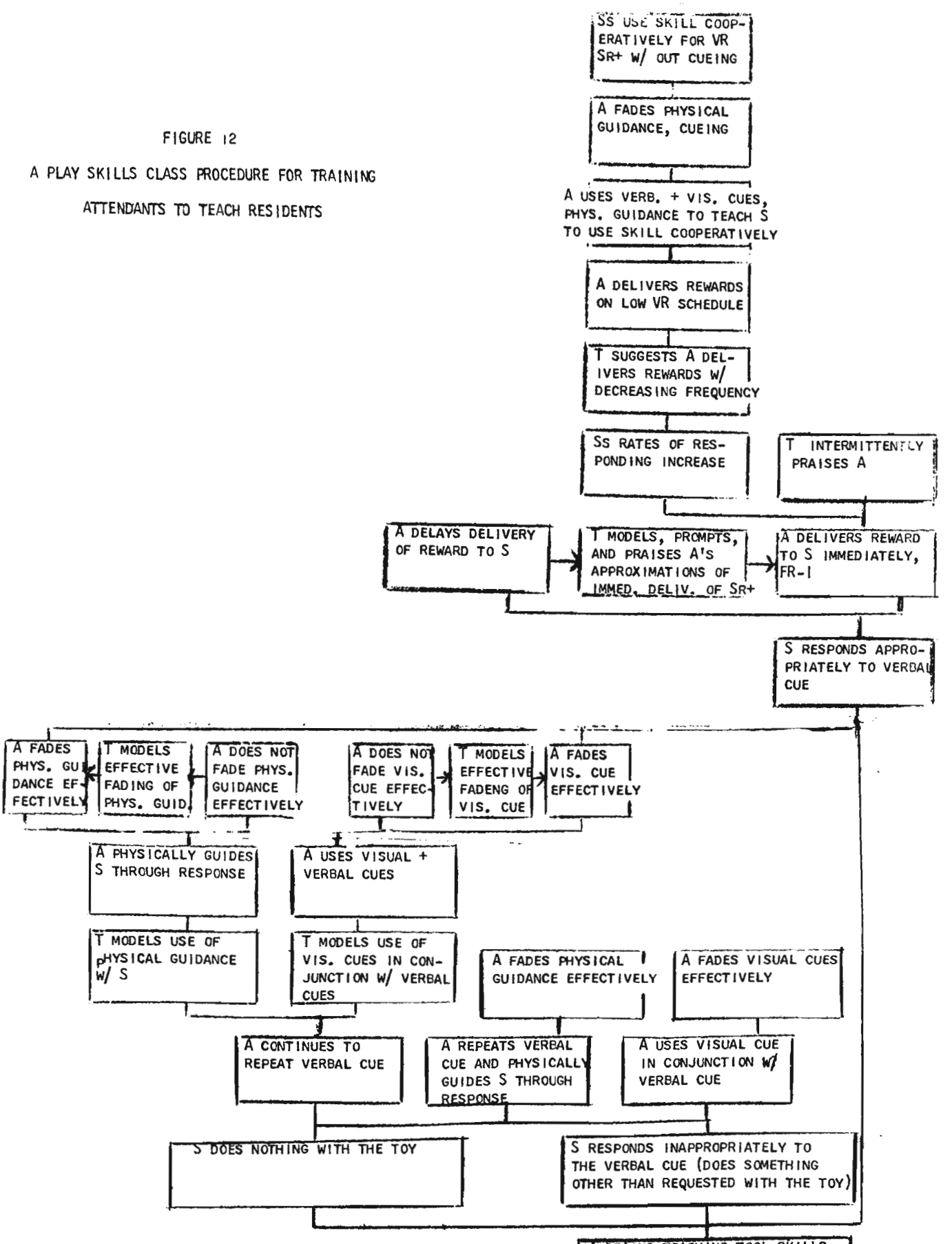
Children's activities during free play were recorded as multiple baselines. Ten three-second observations of each child were made during each free play period. The categories of observation included 1) holding or touching a toy not used with the child during the tutorial period, 2) playing with a non-tutorial toy in a conventional manner, 3) playing with a tutorial toy as taught, 4) playing with a tutorial toy other than as taught, 5) self-stimulating or self-abusing, 6) touching another child, and 7) playing cooperatively with another child.

In the last part of the school year teaching sessions took place in the children's living area and playground to provide a basis for generalizing play skills.

In seven months four attendants learned to use and fade physical guidance and to consequate successive approximations of play skills. These attendants are now able to teach new play skills. For example, on a recent trip to a playground,

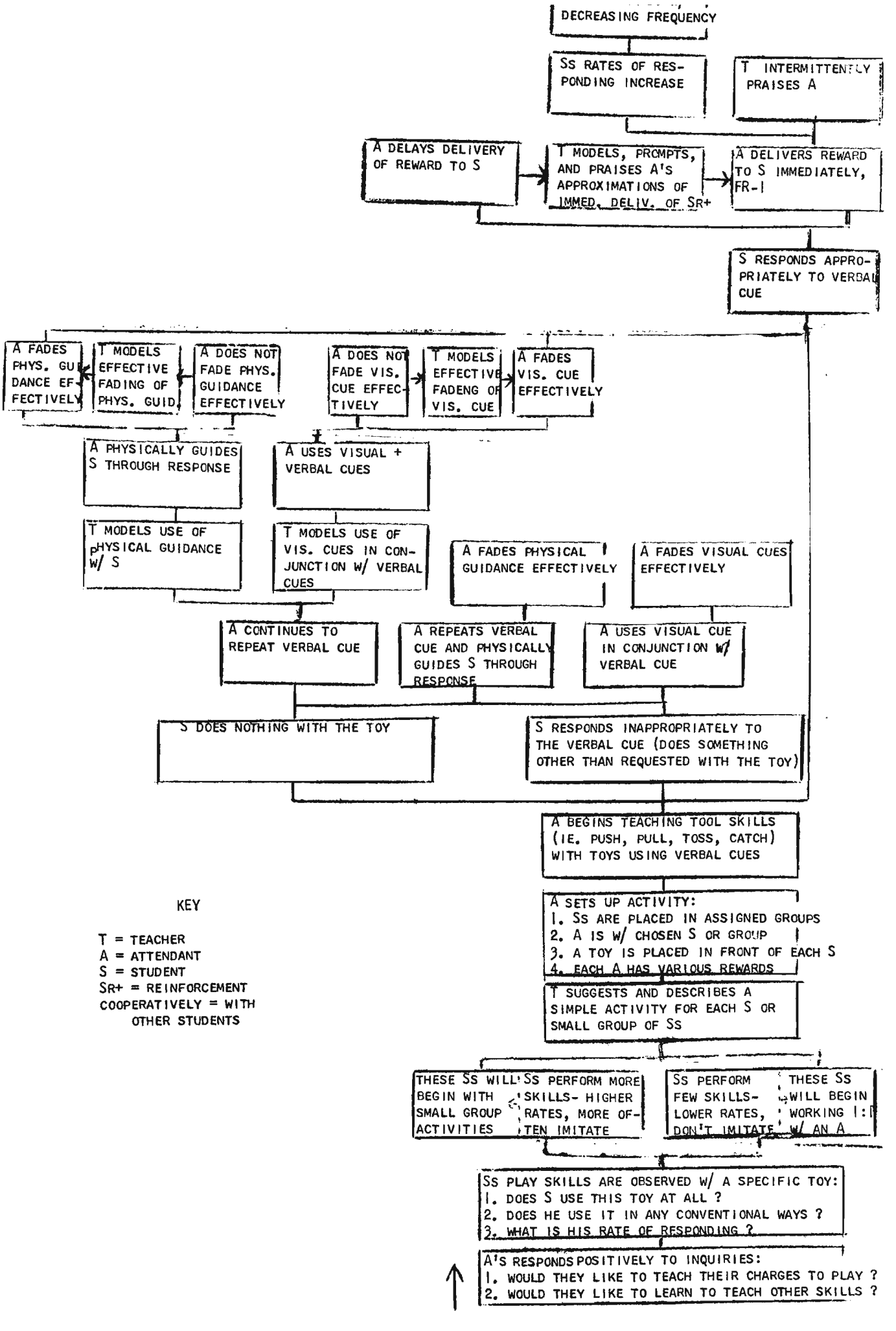
FIGURE 12

A PLAY SKILLS CLASS PROCEDURE FOR TRAINING ATTENDANTS TO TEACH RESIDENTS



KEY

T = TEACHER
A = ATTENDANT
S = STUDENT
SR+ = REINFORCEMENT


DECREASING FREQUENCY
SS RATES OF RESPONDING INCREASE
T INTERMITTENTLY PRAISES A
A DELAYS DELIVERY OF REWARD TO S
T MODELS, PROMPTS, AND PRAISES A'S APPROXIMATIONS OF IMMED. DELIV. OF SR+
A DELIVERS REWARD TO S IMMEDIATELY, FR-1
S RESPONDS APPROPRIATELY TO VERBAL CUE
A FADES PHYS. GUIDANCE EFFECTIVELY
T MODELS EFFECTIVE FADING OF PHYS. GUID.
A DOES NOT FADE PHYS. GUIDANCE EFFECTIVELY
A DOES NOT FADE VIS. CUE EFFECTIVELY
T MODELS EFFECTIVE FADENG OF VIS. CUE
A FADES VIS. CUE EFFECTIVELY
A PHYSICALLY GUIDES S THROUGH RESPONSE
A USES VISUAL + VERBAL CUES
T MODELS USE OF PHYSICAL GUIDANCE W/ S
T MODELS USE OF VIS. CUES IN CONJUNCTION W/ VERBAL CUES
A FADES PHYSICAL GUIDANCE EFFECTIVELY
A FADES VISUAL CUES EFFECTIVELY
A CONTINUES TO REPEAT VERBAL CUE
A REPEATS VERBAL CUE AND PHYSICALLY GUIDES S THROUGH RESPONSE
A USES VISUAL CUE IN CONJUNCTION W/ VERBAL CUE
S DOES NOTHING WITH THE TOY
S RESPONDS INAPPROPRIATELY TO THE VERBAL CUE (DOES SOMETHING OTHER THAN REQUESTED WITH THE TOY)
A BEGINS TEACHING TOOL SKILLS (IE. PUSH, PULL, TOSS, CATCH) WITH TOYS USING VERBAL CUES
A SETS UP ACTIVITY:
1. SS ARE PLACED IN ASSIGNED GROUPS
2. A IS W/ CHOSEN S OR GROUP
3. A TOY IS PLACED IN FRONT OF EACH S
4. EACH A HAS VARIOUS REWARDS
T SUGGESTS AND DESCRIBES A SIMPLE ACTIVITY FOR EACH S OR SMALL GROUP OF SS
THESE SS WILL BEGIN WITH SMALL GROUP ACTIVITIES
SS PERFORM MORE SKILLS- HIGHER RATES, MORE OFTEN IMITATE
SS PERFORM FEW SKILLS- LOWER RATES, DON'T IMITATE
THESE SS WILL BEGIN WORKING 1:1 W/ AN A
SS PLAY SKILLS ARE OBSERVED W/ A SPECIFIC TOY:
1. DOES S USE THIS TOY AT ALL ?
2. DOES HE USE IT IN ANY CONVENTIONAL WAYS ?
3. WHAT IS HIS RATE OF RESPONDING ?
A'S RESPONDS POSITIVELY TO INQUIRIES:
1. WOULD THEY LIKE TO TEACH THEIR CHARGES TO PLAY ?
2. WOULD THEY LIKE TO LEARN TO TEACH OTHER SKILLS ?
KEY
T = TEACHER
A = ATTENDANT
S = STUDENT
SR+ = REINFORCEMENT
COOPERATIVELY = WITH OTHER STUDENTS

all of the children were taught to climb and go down a slide. The attendants now use unplanned ward time to engage the children in play; indeed, we have been told that when they sit down with toys and goodies (reinforcers), most of the children approach them and begin playing.

All of the children have now learned conventional uses of one to eight toys, and seven of the eight children have learned to use most of their play skills in cooperative activities. The children are able to learn new play skills more rapidly and appear eager to join in during play sessions lasting as long as 45 minutes. During play sessions, stereotyped behaviors occur less frequently and aggressive behaviors have completely disappeared. Most of the children, however, play appropriately only when an adult is present. Whether or not edible reinforcers are also a discriminative stimulus for play is not yet known.

The more closely the free play period resembled the tutorial session, the more play was observed during the free period. For all of the children to be involved in play activities, a minimum attendant-child ratio of 1:2 or 1:3 proved necessary.

Attendants and other staff members report that spontaneous individual and cooperative play during free time has increased. The two children who interacted with other children and played with toys least of all were recently observed giggling and touching each other while sharing a ball.

Play skills apparently can be taught by attendants while they are acquiring teaching skills. Although this may not be the most efficient means of training attendant staff, in many settings it would be one of few realistic possibilities. Most institutions do not hold ward staff responsible for teaching residents new skills. Indeed, attendants often have so many custodial duties that little time remains for teaching. Furthermore, allocation of time and funds for in-service training of attendant staff is still rare.

That untrained persons can be easily taught effective teaching techniques while working directly with the children may have even greater implications for non-institutional settings. Day programs for severely retarded children might involve parents, siblings, and other volunteers in similar play skills projects. Optimal use of visiting time might thus be made while the children's families come to view their youngster as a learner . . . and themselves as teachers.

In the play skills project a variety of problems were encountered, the worst one being the problem of staffing. Often, on an already poorly staffed ward, absences reduced attendant participation in teaching. With only one attendant on duty it became impossible to perform custodial tasks and to teach. A sufficiently long adaptation period (see section 1.2) to the new classroom was halted prematurely because the attendants objected to being present while not teaching. With their many other duties, they felt that their time could be better spent. Had we waited until the children were more accustomed to the room, we might have found initial skill acquisition to proceed more rapidly and smoothly.

Occasionally throughout the year, "probe" classes were held in the living unit to see if the youngsters could be taught new skills in that setting as easily as any other. However, the children would not play on the ward at all, even after they had acquired skills in the classroom. Perhaps the children were accustomed to filling their ward time in other ways. The children had also

experienced substantial noncontingent reinforcement on the ward, another factor which might account for this phenomenon. However, after about seven months of play skills sessions in the classroom the children performed similarly in both classroom and living unit.

References for Section 2.1

Berkson, G., and Mason, W. Stereotyped movements of mental defectives: IV. The effects of toys and the character of the acts. American Journal of Mental Deficiency, 1964, 68, 511-524.

Flavell, J.E. Reduction of stereotypies by reinforcement of toy play. Mental Retardation, 1973, 11(4), 21-23.

Luke, D. Developing play in groups of severely and profoundly retarded children. Unpublished doctoral dissertation, Southern Illinois University, 1971.

Former department staff named Program Specialists

This year five Fernald teachers were designated Program Specialists. Three of these teachers, James McCormack, Jr., Hara Bouganim, and Nancy Silver, received a significant portion of their training while working in the Behavior Department.

2.2 In-service training for other DMH personnel

In February, Gene Buchman held an informal workshop on discrimination learning for teachers of the Lowell Developmental Day Care Center.

This spring, at the request of their Head Day Care Center Teacher, Carol Nathan, Dr. Barrett and other Behavior Department staff members held two workshops on behavior analysis and modification for 17 day care teachers from DMH Regions II and III. As a point of departure, many teachers submitted the behavioral objectives they had been working toward with selected pupils. Problems encountered included adequacy of response definition, assessment of entering behaviors to determine available behavior assets, use of dual contingencies and acceleration of alternatives to objectionable behaviors, charting for accountability, and the absence of any curriculum or long-range objectives for the children enrolled.

In general, this group seemed eager to improve their capabilities and their fund of knowledge, but they lack appropriate literature references and reading materials. Most importantly, they do not have the amount of continuing behavior-analytic input they need to do more than attempt to meet crisis situations. They have expressed desire for a continuing relationship with the Behavior Department in an effort to meet these needs.

2.3 Parent training

Gene Buchman conducted two workshops on behavior modification for the Farrell Hall Parents Group. In November, Mr. Buchman discussed and demonstrated backchaining of self-help skills. In January, he focused on errorless learning of academic skills.

In February, Mr. Buchman gave a lecture on learning approaches to retardation to the Parent-Teacher Group of DMH's Lowell Developmental Day Care Center.

2.4 Training for university students

A Boston State College graduate student and former personnel selection psychometrist, Kathleen Ashforth, received supervision from Deborah Pease in a field project designed to decrease inappropriate mouthing of objects by a profoundly retarded teenager in Farrell Hall. Juice and praise were used to reinforce intervals free of the target behavior. This consequence was chosen upon recommendation of the girl's classroom teacher. Although the topography of the mouthing became less pronounced, the frequency showed no reliable change when the classroom reinforcer was delivered following periods when no mouthing occurred on the ward. However, analysis of various types of noncontingent attention regularly given this girl and their functional relationship to her maladaptive behavior revealed that these antecedents had greater control over the frequency of her mouthing than the contingent arrangement of a consequence reported to be reinforcing by her classroom teacher. In addition, other prepotent antecedent stimuli, chronically present in the girl's ward environment mitigated against the effectiveness of any in situ consequential control of her excessive mouthing.

Mrs. Ashforth's introduction to some of the procedures of applied behavior analysis was one that clearly illustrates some of the problems encountered which demand technical expertise well beyond a priori selection of assumed reinforcers--especially without careful analysis of other factors in the daily environment that serve to maintain the behavior to be decelerated.

Six student teachers, five from Boston University and one from Boston College, consulted regularly with Gene Buchman and Deborah Pease. Hara Bouganim had formal responsibility for supervising the students' field work.

Dr. Barrett and Mr. Buchman have been asked to teach courses during the coming academic year in Lesley College's programs to train graduate students to teach severely multiply handicapped and severely developmentally disabled children.

2.5 Vocational training for adult residents

After five years of training in increasingly complex tasks and increasing responsibility in a variety of areas, and despite his unit staff's agreement last summer that he should continue his On-the-Job Training with us, P.S. was abruptly transferred to a workshop placement at Morgan Memorial, where he was to appear every morning at eight o'clock after well over an hour's commute on public transportation (including three changes). P.S. was promised more money, which excited him. About the same time, P.S. was transferred to a different residential building with a new group of peers to relate to. Without any assessment of his entering skills at Morgan Memorial, he was assigned a bench work job involving use of pliers to straighten small wires on electronic components. Although P.S. had clearly demonstrated precise visual pattern discrimination via the extraordinarily difficult jigsaw puzzles he used to assemble in his leisure time, he had never before used pliers. Further, he had never been expected to do the same small piecework repetitiously for an entire workday. No training was made available to him at Morgan Memorial. He made no money because his job performance was not acceptable. After two weeks he

was transferred to "heavy janitorial work"--again without prior assessment. In his work with us, he repeatedly demonstrated his poor muscle tone and his lack of endurance when doing physically strenous work. From time to time staff members have had him do muscle-building exercises, but at no time has he engaged in the regular physical activity that would have enabled him to perform adequately with heavy equipment.

During his placement at Morgan Memorial, he demonstrated that he did not know how to budget his money. He borrowed money from a Fernald dormitory-mate. When he was unable to repay the loan, he was assaulted by the lender. At this point, his mother withdrew him from Fernald to live at home. She planned to find him a job through Mass. Rehab. P.S. said he was happy to be away from Fernald, yet he called us quite frequently, at times daily, suggesting that he missed his contacts with our staff. He repeatedly asked who was emptying our wastebaskets, replenishing our cleaning supplies, sweeping our floor, and answering our telephones (jobs he routinely did with us).

We surely hope P.S. will somehow succeed in his new life, but we are skeptical because he was placed in community work without adequate preparation and without assessment of the skills he had at the time.

G.B. has been getting On-the-Job Training in janitorial skills under Carl Binder's supervision. He has also been receiving training in basic numerical skills from Deborah Pease (see section 1.9).

D.G. was accepted into a workshop program. He has been serving as a member of the Fernald Human Rights Committee and was elected president of the Fernald cerebral palsy group.

3.0 COMMUNICATION

3.1 New publications

Barrett, B.H. Review of A Guide to Behavioral Analysis and Therapy by R.P. Liberman (New York: Pergamon, 1972). Selected Media Reviews 1970-73. Arlington, Va.: Council for Exceptional Children, 1973. (Appended)

Barrett, B.H., and McCormack, J.E., Jr. Varied-teacher tutorials: A tactic for generating credible behavior in severely retarded children. Mental Retardation, 1973, 11(6), 14-19. (Appended)

Barrett, B.H. Review of Modifying Retarded Behavior by J.T. Neisworth and R.M. Smith (Boston: Houghton Mifflin, 1973). Behavior Therapy, 1974, 5, 449-452. (Appended)

Barrett, B.H. Review of Modifying Retarded Behavior by J.T. Neisworth and R.M. Smith (Boston: Houghton Mifflin, 1973). Exceptional Children, in press.

3.2 Publications anthologized

Barrett, B.H. Behavioral individuality in four cultural-familially retarded brothers. Behaviour Research and Therapy, 1969, 7, 79-81. REPRINTED IN:

Erickson, M.T., and Williams, B. (Eds.) Readings in Behavior Modification Research with Children. New York: MSS Information Corp., 1973.

Barrett, B.H. Behavior modification in the home: Parents adapt laboratory-developed tactics to bowel-train a 5½-year-old. Psychotherapy: Theory, Research and Practice, 1969, 6, 172-176.
REPRINTED IN:

LeBow, M.D. (Ed.) Improving Patients' Behavior: Readings for the Nurse Practitioner. New York: Appleton-Century-Crofts, in press.

Zlutnick, S., and Katz, R. (Eds.) Behavior Therapy and Health Care: Principles and Applications. New York: Pergamon, in press.

3.3 Distribution of articles

This year we received 99 requests for reprints and other descriptions of our work. We distributed a total of 143 articles and reports.

3.4 Formal presentations

Barrett, B.H. Development of assessment procedures in mental retardation. Annual meeting, Massachusetts Psychological Association, Boston, April 29, 1974.

Buchman, G. An errorless word-recognition program for severely retarded persons. Weekly meeting, Shriver Center Behavior Laboratory, Fernald State School, Waltham, Mass., May 24, 1974.

Barrett, B.H. Reinforcer hierarchies among the moderately and severely retarded. Annual meeting, American Academy on Mental Retardation, Toronto, June 4, 1974.

Binder, C.V. A position paper on "behavior modification." Monthly meeting, Boston Chapter, Association for the Advancement of the Behavior Therapies, Chestnut Hill, Mass., June 4, 1974. (Appended)

3.5 Department tours and lectures

This year, 143 persons, including 77 professionals, visited our laboratory. Well over 100 persons visited our classroom, many of them several times, making a total of 248 visits.

In addition to workshops for DMH personnel (see section 2.0), we arranged special lecture-demonstration sessions for 15 students from St. Cloud (Minn.) State College, 42 from Brandeis University, and 23 from Wellesley College.

3.6 Information seeking visits to other facilities

Carl Binder toured several institutions in the Midwest including Northern Indiana State Children's Hospital in South Bend. Also among his stops was the North Aurora Center, near Chicago, where severely retarded persons are performing complex tasks (e.g., assembling bicycle brakes and electronic circuit boards) in an experimental workshop training program directed by Dr. Marc Gold.

3.7 Attendance at professional meetings, workshops and symposia

Staff members attended the annual conventions of the American Psychological Association, Massachusetts Psychological Association, Association for the Advancement of the Behavior Therapies, American Association on Mental Deficiency, and American Academy on Mental Retardation.

Also: the Annual Brockton Symposium on Behavior Therapy (this year's topic was contingency contracting); St. Elizabeth's Hospital Symposium on Clinical Behavior Modification; weekly meetings of the Boston Behavior Therapy Interest Group (Boston branch of the Association for the Advancement of the Behavior Therapies); the special symposia on Ethical Issues in Mental Retardation held at Fernald School; a meeting on self-abusive behavior in retarded children at the Behavior Research Institute, Providence, R.I.; a symposium on aggressive behavior in mental retardation held at Wrentham State School; weekly meetings of the Shriver Center Behavior Laboratory; and seminars held by the Fernald psychology department.

At the invitation of Professor B.F. Skinner, Carl Binder participated in a series of group discussions about Professor Skinner's new book, About Behaviorism. Gene Buchman also attended several of these sessions.

3.8 Special appointments and consultantships

Dr. Barrett was named a consulting editor for the American Journal of Mental Deficiency.

For a new course on behavior modification with the retarded at the University of Massachusetts (Boston), instructor Judith Jacobs sought Carl Binder's assistance in preparing the course outline and reading list. In November Mr. Binder gave a guest lecture on behavior modification to the class.

Gene Buchman continues to serve as consultant to the Perkins School in Watertown, Mass. In April he held an informal seminar on behavioral teaching techniques for the professional staff of the school's Deaf-Blind Unit.

3.9 Consultation with other professionals

James L. Hamilton, Ph.D., served as a consultant to our department this year. Dr. Hamilton is assistant professor at Lesley College in Cambridge, Mass., and coordinator of Lesley's programs in severe developmental disabilities and severe multiple handicaps.

Eric Haughton, Ed.D., also served as a consultant to our department. Dr. Haughton, an expert on precision teaching, is director of evaluation services, Faculty of Education, York University, Ontario.

4.0 ADMINISTRATION

From its beginning the Behavior Department has been concerned with the development and evaluation of methods for the habilitation of retarded children and adults. In laboratory studies and classroom programs based on well-established behavioral principles, we have shown that such persons are capable of a great deal more than was formerly thought possible, and we have adapted these principles to the development of specific training programs.

Hoping to be maximally helpful to the new administrators at Fernald, during the past year (23 July 1973, 21 November 1973, 2 April 1974, and 3 April 1974) we addressed ourselves to three areas which they told us were high priority within the institution.

To validate teaching programs, in standardized form, for all institution service personnel, we requested staff to partially replace the Title I positions we lost. Unable to carry out this program with a small staff, we sought to serve as a center for the revision and evaluation of programs, as well as the training of staff in their use. Replacement positions for this purpose have not yet been made available.

In response to the need for more effective adult resident training, we offered a proposal for a laboratory-based workshop skills training program that would have involved staff training as well. On the basis of research which has been carried out elsewhere and our own current adult education activities, it is clear that severely retarded people can be taught some rather "sophisticated" skills. We sought to develop a program for this purpose, but the proposal has not yet been acted upon.

Having had some experience in in-service training, we sought to extend our capacities to train teachers and attendants. We submitted a proposal to the superintendent addressed to this problem, but again, we have not had a positive response.

These proposals, as well as other administrative details of the past year, are outlined below.

4.1 Proposal requesting support for program implementation

We have begun to evaluate and train adult residents from Kelley Hall and East Building in quantitative skills, printing, time-telling, currency skills, and certain janitorial skills. We have developed detailed program sequences in printing (see section 1.7), reading (see section 1.8), and numerical skills (see section 1.9) which we would like to implement and evaluate with adult residents. In addition, we are developing automated programs for teaching color skills, quantitative concepts, and other skills (see section 1.4).

This year referrals for training listed approximately 50 Kelley Hall residents who might benefit from our programs (see section 2.0). Because of our over-extended staff involvement, however, our efforts to meet these needs have proceeded at a snail's pace. A certain minimum rate of progress in these efforts seems necessary if our results are to be useful and effective. Therefore, we requested two positions to be filled by persons who would devote their time to two major endeavors: 1) sequencing existing programs that teach the skills prerequisite to programs available from learning research centers, and 2) implement-

ing programs and procedures for staff training. Our proposal has not yet been acted upon.

4.2 Proposal for laboratory-based workshop skills training program

In response to an expressed need at Fernald for carefully task-analyzed programs to teach workshop skills, we drafted a plan to develop automated manual-assembly tasks, precise instructional sequences, a model workshop, and an in-service training program for potential workshop instructors. The proposaal was submitted to then-Assistant Superintendant Robert Audette, Assistant Superintendent Peter Gesell, and the Director of Education and Training, Mr. Steve Santis.

Although our proposal has not been acted upon, we remain hopeful that our plan--or a similar plan--will be considered at a future time. With increasing administrative emphasis on "normalization," there is a growing need for carefully designed job-oriented training programs for severely retarded residents, especially those who may eventually be community-bound. The feasibility of employing severely retarded persons in sheltered, but potentially competitive, workshops has been well demonstrated by the remarkable success of such programs as Dr. Marc Gold's workshop at the North Aurora Center in Illinois. (A brief description of Dr. Gold's work was given in section 5.9 of our 1972-73 annual report.)

4.3 Proposal for development of in-service training programs

A plan for in-service training and program development was submitted to Dr. Moser. On the basis of our experience with in-service training (see sections 2.1 and 2.2), plus the resources we have accumulated and the methods we have developed for design and evaluation of instructional sequences, we thought that we were in a good position to help provide expanded training opportunities for Fernald staff and other DMH personnel. However, despite a growing number of requests for consultation and assistance from Fernald staff, from DMH personnel, and from community centers (see sections 2.1-2.3), the additional positions which would be required to expand these services were not made available to us this year.

4.4 Personnel

In September, Deborah Pease, B.A., joined us as a specialist in task analysis and curriculum development, replacing Shelley McNaughton, who worked with us for the summer months. In January, Deborah S. Leeman, B.A., replaced Betty Falle as half-time special services assistant.

Barbara Colby, B.A., continued as data analyst; Judith Rosenberg, A.B., as communication and information-retrieval specialist; and Carl Binder, B.A., and Gene Buchman, B.A., as research associates (Mr. Buchman half-time). Hara Bouganim, Ed.M., a Farrell Hall apartment coordinator, continued to spend part of her time in our department.

Gail Paul, M.Ed., laboratory teacher, left in September when Title I positions were withdrawn from our department. Nancy Silver, Mandy Chalmers, Janet Siegler Fentin, and Jeanne Wilson, all holding Title I positions, were reassigned elsewhere in the institution.

Two volunteers from Wellesley College assisted in teaching. Seven other college students helped paint the walls in our classroom (see section 4.7).

4.5 Job applicant referral hired by CERC

Our department receives job applications from people trained in the most outstanding behavior-analytic programs in the country. As in the past, we have continued to refer exceptional applicants to the CERC Psychology Department, to Mr. Gesell, or to Dr. Sorensen. This year we were delighted at the staff's response to Eric Ward, a doctoral candidate and former classmate of Carl Binder's at Notre Dame, referred to Dr. Wheeler in the Psychology Department. We look forward to productive interaction with Mr. Ward when he begins work at Fernald in the fall.

4.6 NIMH Small Grant for study of concurrent performances

Carl Binder received a small grant for equipment from the National Institute of Mental Health to study "Concurrent Performances in Retarded Children." Apparatus construction is now under way.

Mr. Binder's investigation will have three main objectives: 1) to determine the degree to which people with retarded behavior are sensitive to differences in rates of reinforcement and whether their behavior follows the quantified rules derived from similar research with normal persons and with small animals, 2) to examine reinforcer preferences in a concurrent situation, 3) to determine if stimuli which are preferred as consequences of behavior are more "salient" as antecedent stimuli than stimuli which are less preferred.

4.7 Losses and gains in equipment and facilities

Last September we returned from the Labor Day holiday to find that our classroom and adult training areas had been virtually stripped of furnishings and teaching materials by Title I personnel who had been reassigned to ward service functions. Specially-designed tables for the tutorial cubicles, classroom tables and chairs, cabinets, and desks (including three that had been donated to the Behavior Department) were gone, as were instructional materials, which had not been purchased with Title I funds. We were simply appalled. We were appalled partly because the Behavior Department was responsible for bringing the Title I monies to Fernald and for developing the educational programs for severely and profoundly retarded children that had earned yearly renewals of that grant since 1967. But mainly we were appalled that furnishings and materials would be removed from our department--or any other area of the institution--without so much as the courtesy of advance notice and over a holiday weekend when the director and other department staff were expected to be away.

We are especially delighted that badly needed fluorescent lighting and electrical outlets will soon be installed in our adult training area. A contract for vinyl asbestos flooring for our classroom has also been awarded. We are eagerly looking forward to this improvement over the existing cracked (and uncleanable) cement floor. The new flooring, along with the bright yellow walls painted this year by generous volunteers, should make our classroom noticeably more cheerful as well as considerably more hygienic!

4.8 Ad Hoc Committee of DMH Researchers

Dr. Barrett has been serving on this committee, an 11-member group formed last year at the suggestion of George Grosser, Ph.D., Assistant Commissioner for Research, Planning, and Training. The committee's function is to provide input to Dr. Grosser and other DMH administrators with respect to the role of research in the department, ethical issues in research with human subjects, potentially restrictive legislation, and other similar issues.

4.9 Dr. Barrett has been licensed by the Massachusetts Board of Registration of Psychologists (License No. 44).


NO
JOB IS FINISHED
UNTIL THE
PAPER WORK IS
DONE!