ABSTRACT

ANALYSIS OF A METHOD

OF TRAINING THE MENTALLY RETARDED

by Marjorie Ann Yascolt

This non-comparative study was undertaken to explore the practibility and possibility of training the severely retarded on prepositional and abstract concepts in response to verbal commands. Fourteen institutionalized severely retarded children and young adults served as subjects. Eight were trained on a Multiple Differential Response And Feedback Apparatus (MUDRAFA) using a methodology which specified the deficits of the retarded subject and applied learning principles to overcome them.

It seemed that knowing a high initial number of concepts at pretest led to faster subsequent learning, but this made no appreciable difference in retention. Subjects knowing a low initial number of concepts retained as well as those with a high initial number.

That subjects could learn to use verbal mediation is evidenced by the fact that some non-verbal subjects were trained to read meaningfully. It was concluded that MUDRAFA was effective in bringing the behavior of the retardate under the control of abstract verbal commands.

Specific recommendations concerning the use of MUDRAFA and how to interact with the child were given. Implications of this study for further learning research were also discussed.

Approved M. Ray Denny
Major Professor

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OF TRAINING THE MENTALLY RETARDED

by

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CHAPTER I

INTRODUCTION

This study attempted to explore the effectiveness of a method for training the mentally retarded. The broad aim is to facilitate more independent living on the part of the retardate by bringing his behavior under better control of verbal stimuli. This means training him to respond appropriately to a large variety of verbal commands from the experimenter or parent.

Since this was an exploratory study, no hypotheses were generated. Our basic premise is that the severely mentally retarded can learn and retain well, but that they suffer certain deficits in the conditions of learning. We have attempted to identify these deficits and to employ optimal conditions and principles of learning to overcome them.

Benoit (1957) considers attention to be the primary factor in learning. For the mentally retarded, the focus of attention is largely determined by the stimuli around them. When learning is incomplete, a complex situation leads to mass activation which results in disorganized behavior. At the beginning of training he recommends simplifying the context by diminishing the over-all stimulation so that a response will not be disrupted while it is in the process of

being reinforced in a repetitional series. Later, after the response is fairly well strengthened, these precautions may be eliminated.

Zeaman & House (1961) in a study of two-choice spatial and delayed responses attributed the absence of a delay-learning-set in the mentally retarded to position habits and perseveration errors. These habits and errors were ascribed to a deficit in the attention function. In 1963, they related the inhibition deficit to the poor attention or distractibility to account for the mentally retarded subject's ignoring the relevant stimuli.

Denny (1964) suggests that the inhibition deficit may be more basic than the attention deficit, that is, the subject's failure to inhibit the effects of extraneous stimuli accounts for his inability to attend to the task. Since the subject cannot inhibit responses to other stimuli, he cannot attend to a set of stimuli for any length of time. In any event, the retarded subject lacks the self-initiated sets which allow for consistent and continued responding. For Zeaman & House (1961), the delayed response deficit is also related to the lack of ability to maintain a self-initiated set.

Because the mentally retarded are more stimulus bound than normal (Benoit, 1957; Denny, 1964) and respond more to irrelevant stimuli and engage in task irrelevant behavior (Cruse, 1961; Terdal, 1965), this may lead to an incidental

learning deficit in the retarded. In incidental learning an individual must maintain sets which are not established for him as they are in intentional learning. Because the mentally retarded are distractable and show poor ability to establish sets, they do not encounter consistent pairings of stimulus and response. When the mentally retarded are sufficiently well instructed or guided, as under intentional learning conditions, they often do not show a learning deficit (Denny, 1964). For example, Stevenson (1960) in two experiments on object and pattern discriminations found no difference between mentally retarded and normal subjects when matched on MA. Singer (1963) has found that the mentally retarded are poor incidental learners. On a passive incidental learning task in which there was no response involved, the mentally retarded showed a marked deficit. A misdirected task in which the subject was to respond with the color of an object revealed a less severe deficit. There was no significant difference between the mentally retarded and normal subjects on an intentional learning task. Baumeister (1963) found an incidental learning deficit in the mentally retarded on an immediate recall test, but the normals and mentally retarded were equal on a recognition test of incidental material 48 hours later. These data indicate the need for the mentally retarded to be directed and guided in every step of the learning process.

Presumably, an incidental learning deficit makes it difficult to perform extended behavior sequences, especially

with respect to language behavior. The mentally retarded may know familiar objects such as chair, table, or food well, but prepositional and relational concepts such as behind, through, and over are known only very poorly and are extremely difficult to learn because the subject must attend to the relevant stimulus over a time span to learn its meaning. Such a deficit could account in part for the lack of verbal behavior in the mentally retarded. Griffith, Spitz, and Lipman (1959) in an abstraction task found that the mentally retarded seem to be about three years behind their MA in language development. Luria and Vinogradovia (1959) point out the dissociation between the verbal and motor systems in the mentally retarded. They state that the language function has not developed sufficiently to regulate the behavior of the subject; inhibition is impaired and differential conditioning is poor. The subject fails to inhibit because of a lack of verbal control. He does not attend to the subtle verbal cues because of his relative inability to inhibit other responses.

Thus, the mentally retarded suffer from deficits in learning which seem to stem from deficits in duration of attention, incidental learning, inhibition, and verbal mediation and behavior.

One set of principles which have been found useful in training the mentally retarded are presented below (Denny, 1966) and are placed in the framework of Elicitation Theory (Denny and Adelman, 1955). According to this position the

main parameters of learning constitute ways in which the situation can be arranged so that the organism makes or continues to make the designated response. These principles attack the deficits listed above by a methodology which employs optimal conditions in the intentional learning of abstract concepts, prepositional phrases, and relational concepts.

The main principle is the elicitation or specification of the response. According to Elicitation theory learning occurs only when a response is consistently elicited in a given stimulus situation each time the stimulus is present. In order to insure elicitation of the correct response without evoking competing responses, barriers are used so that the subject can choose only the correct alternative. The use of barriers is particularly important because the mentally retarded tend to perseverate and follow position responses (House and Zeaman, 1958; Kaufman, 1959) and make little use of negative cues (House, Orlando, and Zeaman, 1957; Oatley, 1965). Once the response is strengthened, the barriers are opened up. Crutch cues, manual assistance, and coaching are also liberally used at first to specify the response and are later dropped out.

It seems possible that the mentally retarded fail to form the associations necessary for adequate adaptive behavior partially because the ambiguous and inconsistent reinforcement supplied by the normal environment does not lead to adequate discrimination between the relevant and

irrelevant cues in the multiplicity of stimuli impinging upon them. A light, social-verbal reinforcement, tangible and token reinforcement provide immediate knowledge of results necessary to specify the correct response and form these associations. This is particularly important in the later stages of learning when other alternatives are available to the subject. The correct response is immediately followed by the light and incentive the incorrect response is not reinforced and a different response must be made.

The role of kinesthetic feedback is also emphasized since the occurrence of motor responses to relevant cues facilitates learning (Smith and Means, 1961). The method outlined below allows the subject to perform the response, to see his response, etc., so that the subject provides himself with a discriminative stimulus as well as having someone else provide it with a light and social-verbal reinforcement. Such cross modality learning has been found to facilitate learning (O'Connor and Hermelin, 1962; Hayden, 1966). Differential visual, auditory, kinesthetic and/or tactual feedback also identify whether or not the associated response was correct.

Cole and Shaefer (1961) found that generalization of learned response occurs in the severely mentally retarded in much the same fashion as in monkeys and man. In order to promote stimulus generalization and positive transfer, we train for the meaning of each concept in a variety of different contexts and use different versions of the same

stimulus quality or object. In concept training the generalized response is inhibitory in nature. Thus relevant cues continue to elicit the appropriate response while nonessential contextual cues tend to remain irrelevant.

In order that the concept be the only aspect of the total stimulus situation which is a consistently relevant cue, we must randomize the contextual stimuli. All other possible cues such as position, shape or size of slot, etc. are randomized so that the correct response is consistently associated with the same cue in a series of like commands.

Lance (1965) found that the mentally retarded benefit more from overlearning than normals, and are identical to normals on savings scores under conditions of overlearning. This repetition of learning yields best results when it is distributed within a session and across sessions. The repeated use introduces a variety of contexts and thus increases generalization and transfer.

Elicitation theory emphasizes the importance of incentives and the removal of incentives as consistent eliciters of the to be learned response. That is, there is no learning of a differential response without the presence of an incentive in the goal which elicits approach and conditions avoidance of wrong alternatives. The reinforcement gets the organism to make the response which the experimenter has designated to be learned. The mentally retarded subject must be interested and remain interested in the task in order to make appropriate responses and to

maintain these responses without making alternative responses. High success (Butterfield, 1963; Kass and Stevenson, 1961) and switching of incentives (Aldrich and Doll, 1931) has been noted to increase performance of the mentally retarded. Therefore we select the agent most reinforcing to the subject to maintain his attention and interest in the task. Also a variety of incentives, a variety of commands, and a whistle, are used to maintain attention.

An obstruction to getting the behavior of the mentally retarded under verbal control is the dissociation between their verbal and motor systems. O'Connor and Hermelin (1962) found that the advantage of a cross modality situation is lost when verbal encoding is prevented. Therefore we train for specific use of the language by having the subject verbalize the concept and by building in verbal mediators for guiding and directing his own behavior.

The more complex responses are obtained through shaping techniques which involve reinforcement of behaviors successively approximating the criterion behavior. Through chaining of responses by shaping techniques, the abstract concepts which are difficult for the mentally retarded to learn by other less explicit methods are developed and made resistant to extinction. In this sequential building we take advantage of positive transfer by shaping in easy steps on what has previously been learned.

CHAPTER II

METHOD

Subjects Fourteen institutionalized mentally retarded children and young adults, ranging in age from 5 to 33 years, and recorded MA from 7 months to 4 years, 3 months, were selected from Howell State Hospital. Six of these subjects served as controls and were roughly matched with the experimental subjects on the basis of number of initial concepts known, MA, CA, and ward. The subjects were preselected over a 10 week interaction and observation period on the basis of overall responsiveness and physical capacity. Overall responsiveness included attending to clapping hands, verbalization of the subject's name, following hand movement with eyes, and behavior on the ward. Only subjects with extreme spasticity (i.e., could not grasp and hold onto an object) were eliminated. Hospital records were then investigated to determine CA, MA, and IQ. This study was to have included only subjects with an MA of at least two years, however, two younger subjects with recorded MA of 7 months were retained. Since the purpose of this study was to explore the effectiveness of a method for training the severely retarded, a representative sample was considered to be important and therefore selection was not made on the basis of type of retardation.

Materials The subjects were taken individually from the hospital to an unused building in which the office and experimental room were located. The experimental room was carpeted, free of distracting stimuli, and contained two chairs (for experimenter and subject) and MUDRAFA.

Stimuli for the individual subject, primary and secondary reinforcers, and Sticky-Gum for attaching stimuli were kept inside MUDRAFA.

Stimuli and crutch cues were cutouts from Sears catalogues and children's magazines, and were pasted on heavy paper ($1\frac{1}{2}$ x $1\frac{1}{2}$ in.). Categories of stimuli included: human (parts of body, faces, people jumping, people sitting,...); animal (cats, dogs, rabbits,...); clothing (shoes, coats, dresses,..); household furnishings (plates, televisions, beds,...); toys (trucks, stuffed animals, bicycles,...); colors (any and all of the above, paint chips, colored pipe cleaners, colored tissue); and forms (3 and 2 dimensional plastic, wooden, and paper objects). Varied reinforcers included paper money, marshmallows, baseball cards, Christmas cards, trinkets, toys, magazines, and 2" x 2" ceramic tiles. Tally sheets (entered daily for each subject) listed experimenter, subject, length of session, number of concepts trained for, number of slots open, number correct, number wrong, percentage reinforcement, reinforcers used, and comments.

Apparatus The training apparatus, a Multiple Differential Response And Feedback Apparatus (MUDRAFA) is essentially the same as the Multiple Operant Problem Solving Aparatus (MOPSA)

which was developed as a therapeutic procedure for chronic schizophrenics (King, Armitage, and Tilton, 1960). MUDRAPA is a 2' x 2' x 2' wooden cube, open on one side, with a sloping front panel. Independent of the rest of the front panel is a 16" x 16" panel containing a cross like aperture which can be rotated and thus oriented in four directions. Rotation of the board prevents a particular slot in the aperture from becoming a cue for a response. The 4 slots are each of different lengths and widths. The varying lengths and widths of the slots allow differential kinesthetic feedback for each response made. The slots can be closed off by means of transparent plastic barriers, thus allowing specification of a particular response with the gradual opening of the other slots. Projecting from the center of the crosslike opening is a metal lever with a translucent plastic handle in which a light is mounted. This light is operated by the experimenter for a correct response. A small white pointer may be attached to the lever so that the subject can go in front of and behind stimuli. This lever is maintained in neutral position at the center by tension springs. The stimuli or crutch cues can be placed at any position on the panel with Sticky-Gum so that the subject can "move to the apple," "go next to the cat," "go over the eyes..."

Procedure Phase I - interaction, observation, and selection: This phase consisted of observation of the subjects on the wards, selection of children, and filling out the

general information page of the Concept Knowledge Test. The subject was played with, taken outside, and familiarized with the experimental room. Also during this phase the agent most reinforcing to the child was determined. Pretest was conducted in the hospital playroom and during interaction with the child on the hospital premises. Scores on pretest and retests were number of concepts known. Criterion for knowledge was performance of all four tasks under a concept.

Phase IIE (Experimental Subjects) - training: After the subject had been familiarized with the experimental room, shaping of a response to approach the machine and to reach and hold the lever began. Guidance in the form of manually assisted responses and crutch cues were liberally used at the beginning of training and dropped out later. Subjects were trained from concrete to more abstract concepts (e.g., first "go to (object familiar to subject)," then "go to red," and finally "go through red"). Time in the experimental situation was gradually increased from 4 to 45 minutes, always stopping before the subject became tired or showed signs of the situation becoming aversive. A retest followed training. Retest for group I experimentals followed 10 weeks of training, after which they were trained for 8 more weeks, were retested, and then went to phase III. Group II experimentals were retested after 8 weeks of training, and then went directly to phase III.

Phase IIC (Control Subjects) - interaction, imitation, play activity: Subjects were engaged in play activities

on a 2 or 4 year level which encouraged muscle coordination, eye-hand coordination, and attending to the activity.* Again, the subject was returned to the ward before he became tired. In imitation activity the subject was told "do this" in building up a sequence of behavior such as patting head, extending arm, clapping hands, picking up crayon,... These subjects were also shown pictures and read to from pre-school children's books. They were reinforced with candy at the end of each play session. Subjects were retested at the end of 10 weeks.

Phase III - No contact period: During this time there was no interaction with the subject by the experimenter. At the end of 5 weeks the subject was retested to determine retention of the concepts over the rest interval.

Training sessions were held 5 days a week. Each session the machine was checked over, stimuli and reinforcers selected, and tally sheet prepared. The subject was then taken from the hospital directly to the distraction free experimental room, using concepts along the way (e.g., push the elevator button, open the door, look at the red car,...) At first no more than 2 or 3 concepts were covered per session, with each session lasting no longer than 4 or 5 minutes. The situation was to remain a pleasant one for the subject and he was always removed before he became bored or fatigued. If the subject's attention wandered during the

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*Activities planned by Miss Carmen V. Arnew, Department of Physical Education, Michigan State University.

experiment, the experimenter clapped his hands, blew a whistle, or banged the front of the machine. A wide variety and number of concepts in a time span of 45 to 60 minutes was gradually built up as the subject became more attentive.

Concepts first used were such as up, down, right, and left. After these were mastered, more abstract and prepositional concepts were trained for. Three more advanced subjects were then trained intensively on the concept of numerousity by presenting 1, 2, and 3 objects on the board with the symbols under them, then addition and subtraction of these objects. They were later trained on the symbols and words for numbers up to ten. Letters making up simple words, words in conjunction with pictures, and phrases using these words were then taught.

A picture with the word were presented together at the end of one slot, the letters making up the word were presented at the other three slots. The subject was trained to go to one letter, opening up the slots gradually. Then he was trained on each of the other letters. He was then trained to go to the letters in a sequence which spelled the word, and finally to the word itself. After, complex words and phrases which could be used on the wards were taught these subjects. During the initial training of a concept the subject was assisted and given manual guidance, if necessary, as well as verbal instructions by the experimenter. Concepts and commands were repeated within a session so the child would not acquire a set to do something different each time.

Concepts were repeated across sessions to provide overlearning and give the subject the opportunity to perform a concept he already knows.

Responses were shaped by reinforcing approximating behavior. Crutch cues in the form of arrows and known stimuli were liberally used at first and then dropped out as a concept was better learned. Since the retarded subject tends to perseverate, all but the appropriate response was blocked off by means of the transparent plastic barriers. As the subject came to respond with shorter latency, the barriers were opened up one at a time. If the subject made an error he was told "no" or "wrong." If the error persisted barriers were closed and gradually reopened.

In order for generalization (i.e., transfer into daily life) of a concept to occur, we maximized the stimulus context in which it occurred. To accomplish this with MUDRAFA, we used a variety of commands and presentation of stimuli. We varied the position and orientation of stimuli by different placements and by rotating the face plate. Commands were varied by different intonation and phrasing, as well as mixing the commands.

Secondary reinforcers (ceramic tiles) were built up on a percentage reinforcement schedule. For each response, the subject received a tile token, and for an increasing (over sessions) number of tokens he received a primary reinforcer. This type of schedule was introduced to prevent

extinction of the response and to decrease the rate of satiation by increasingly sparing use of the primary reinforcer.

CHAPTER III

RESULTS

During the first week or two, learning proceeded slowly and there was poor retention from session to session. After this initial period of adjustment, the experimental group showed a fairly rapid learning rate. Subjects 1, 2, 3, and 4 (experimental group I) respectively acquired 53, 11, 33, and 19 concepts. Subjects 5, 6, 7, and 8 (experimental group II) respectively acquired 3, 17, 34, and 3 concepts. In the control group, subjects 9 and 13 lost one concept, subject 12 lost 3 concepts, subject 11 gained 5, and subjects 10 and 14 remained the same. Subject number 11 did show a slight increase. This subject would not pick out colors during pretesting. During play activity, it was discovered that he used colors appropriately and at retest he responded to naming of the colors. This subject was particularly shy and it is very likely that the increase is due to his feeling at greater ease with the experimenter during the later session. A t-test based on the mean number of concepts acquired per week for both experimental groups as compared with the control group was significant at the 0.05 level ($t=1.78$, $df=12$). Figures 1 to 8 indicate that experimental subjects in both groups I and II with a high initial number of concepts

tend to have a steeper acquisition slope (i.e., they learned more concepts within a certain time span than subjects with low initial number of concepts, However, there was no difference in retention. Both subjects with high and low number of initial concepts known showed good retention over a 5 week period. The only exception is experimental subject number 3, for whom it was difficult to determine a reinforcing agent. For this subject the experimental situation became increasingly aversive and he was later excluded from the study.

Qualitative results The two subjects with MA's of 7 months were retained in this study since the experimenter concluded that a long observation period was a more valid estimate of ability than a report which ended with the statement "the psychologist was kicked thoroughly throughout the testing." Subjects differed in the amount of time that they could be kept in the experimental room and the rate at which tokens could be introduced and increased. One highly distractible subject would not attend to the machine but rather approached the experimenter. Another subject was then put on the machine and was reinforced while he watched. After two sessions of the other subject responding and being reinforced, the distractible subject vocalized and approached the machine while pointing to his mouth. This behavior was reinforced and further training proceeded quite well.

Miniature marshmallows were finally used as the only

candy reinforcer since other candies required chewing and caused subjects to choke, thus distracting the subject from the experimental situation. The light in the lever was found to be particularly reinforcing as is indicated by the gesturing and vocalizing of the subjects when the light had gone out one day. The experimental session had to be discontinued as a result. The tokens (ceramic tiles) seemed to acquire a great deal of reinforcing value to the subject. The subjects smiled and seemed to obtain pleasure from stacking up a number of tokens and turning them in. One subject even stole a few tokens to take back to the ward rather than turn them in. The tokens produced less reinforcer intrusiveness than other tangibles (candy, trinkets) which were often investigated by the subject before putting them down or eating. Decreased latency for accepting the tokens was found to be a good indicator of when it was feasible to increase percentage reinforcement.

Reading (letters, words, and sentences) were found to be highly motivating. The subjects to whom reading had been introduced (numbers 1, 3 and 7) were taken off tangible reinforcers and tokens and received a marshmallow and trinket only at the end of the session. Only the light and social-verbal reinforcement were given during the session. Nevertheless, reading was well learned and retained from session to session. All subjects rapidly learned their own name. Subject number 3, a semi-verbal mongoloid, responded well to animal pictures and household articles. Subjects number 1 and

7, non-verbal cerebral palsied spastics most quickly learned phrases that involved them and that could be used on the wards as, for example, "I am tired," "I am hungry," "Please give Rayford a drink of water." These subjects were later given a set of 3" x 5" cards on which these phrases were printed to use in the hospital. A good understanding of the sentences is demonstrated by the subjects' use of the sentences in a variety of contexts. For example, when asked "What should I have said when I came in?" the subject went to "Good morning, Kathy," the only correct alternative for the situation. Thus, verbal mediation and its use had been introduced in both verbal and non-verbal subjects.

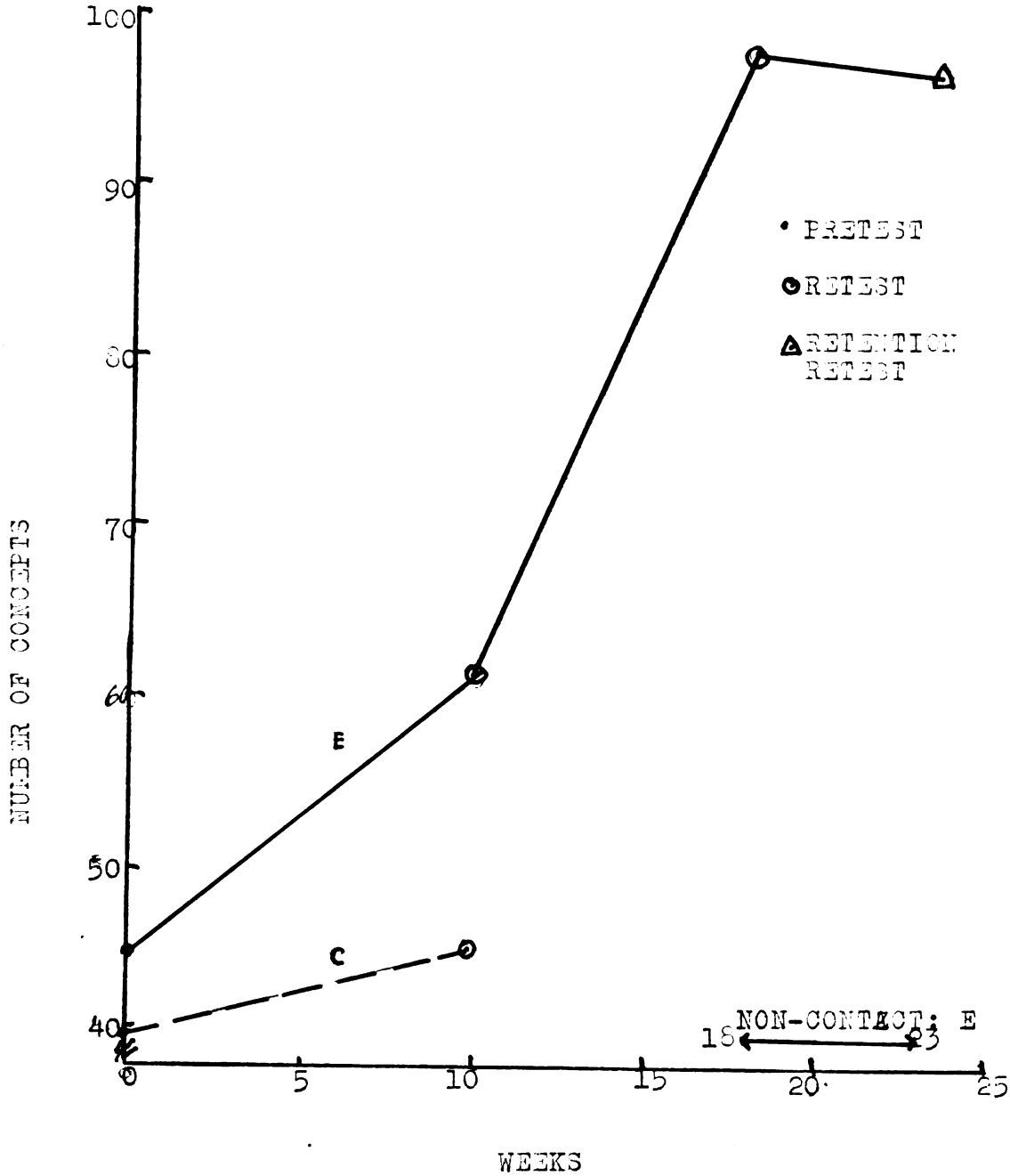

FIGURE 1. CONCEPT ACQUISITION AND RETENTION OF EXPERIMENTAL SUBJECT 1 AND CONTROL SUBJECT 11.

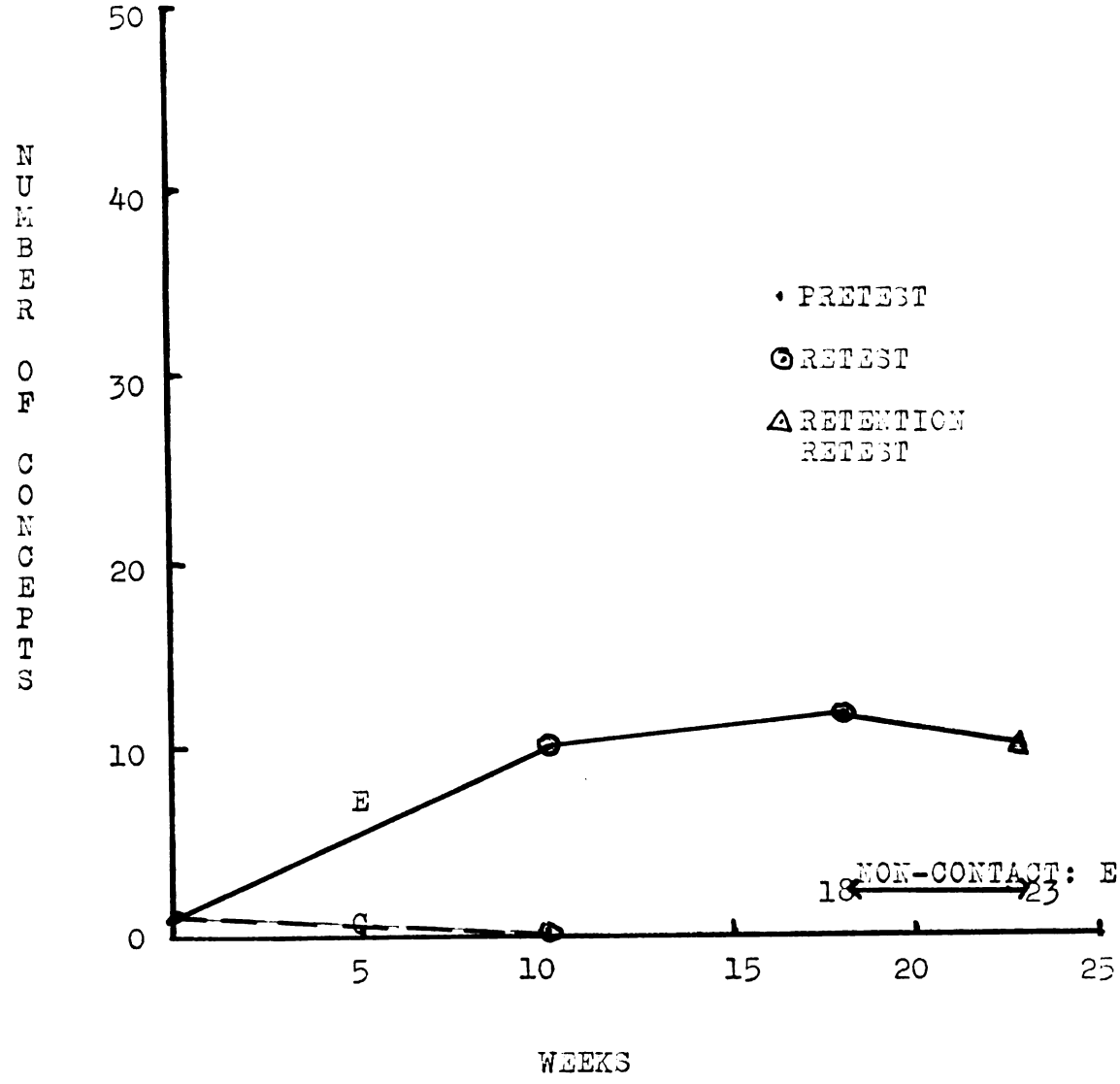

Figure 2. CONCEPT ACQUISITION AND RETENTION OF EXPERIMENTAL S 2 AND CONTROL S 9.

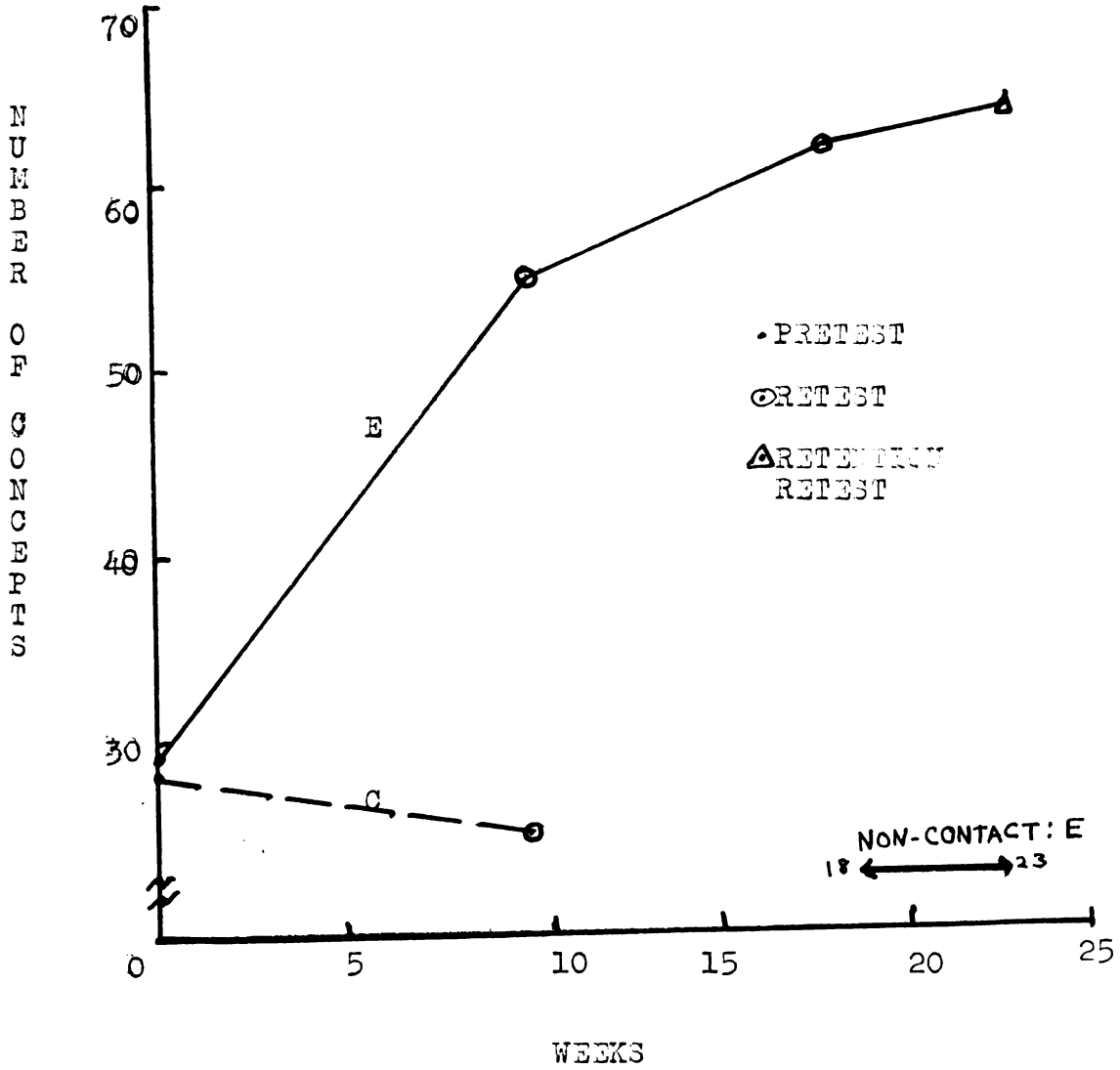

Figure 3. CONCEPT ACQUISITION AND RETENTION OF EXPERIMENTAL S 3 and CONTROL S 12.

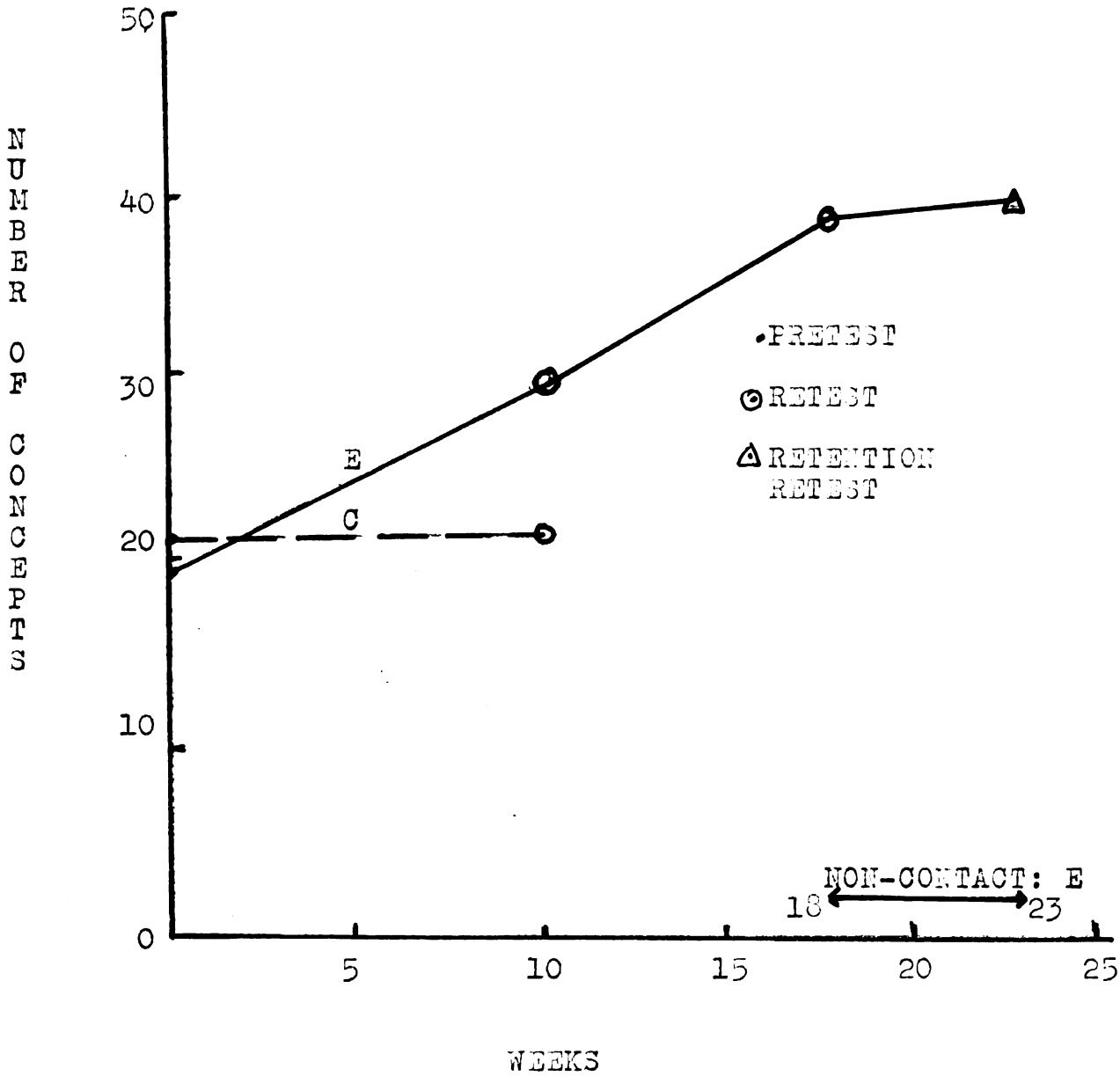

Figure 4. CONCEPT ACQUISITION AND RETENTION OF EXPERIMENTAL S 4 AND CONTROL S 10.

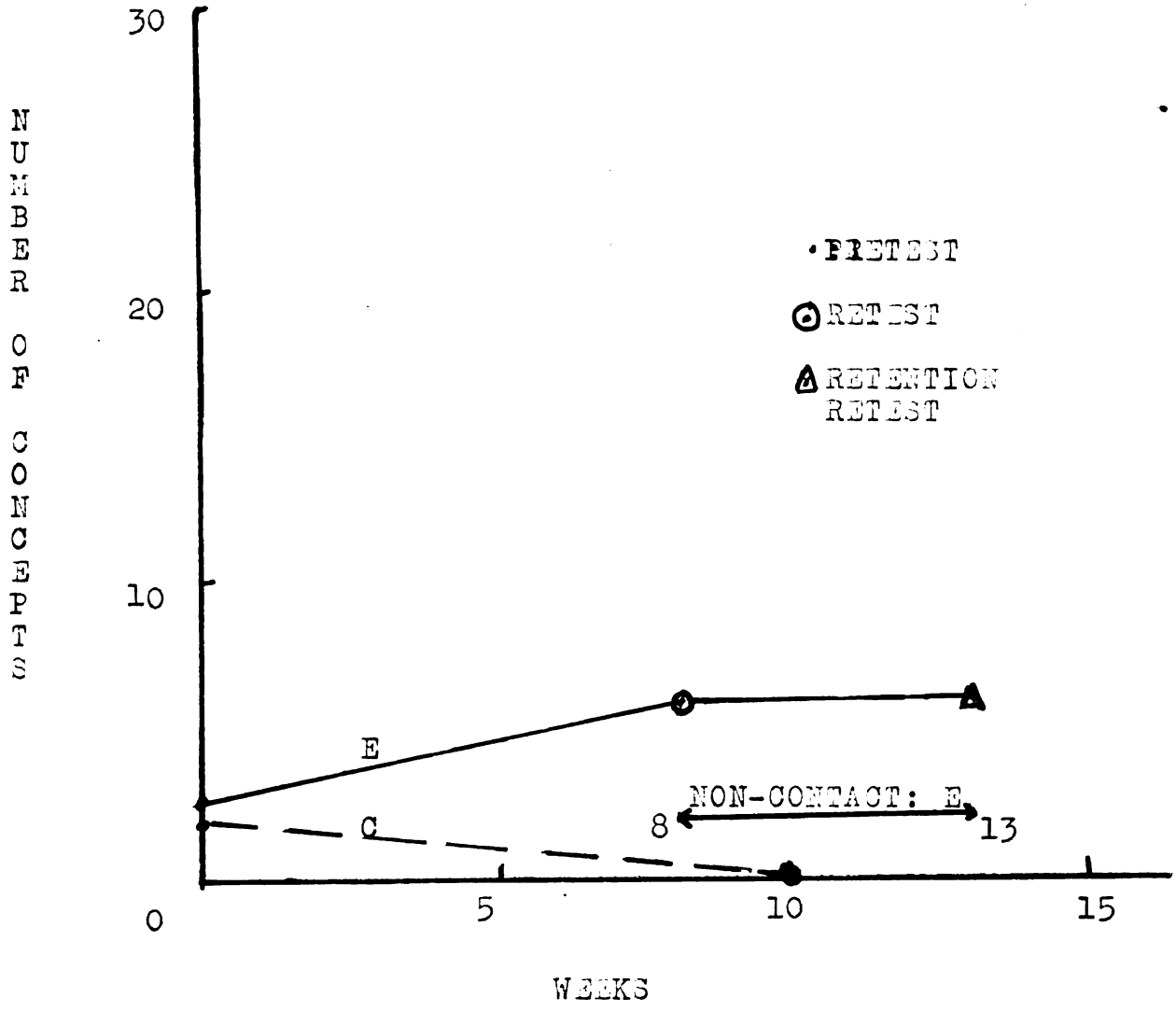

Figure 5. CONCEPT ACQUISITION AND RETENTION OF EXPERIMENTAL S 5 AND CONTROL S 13.

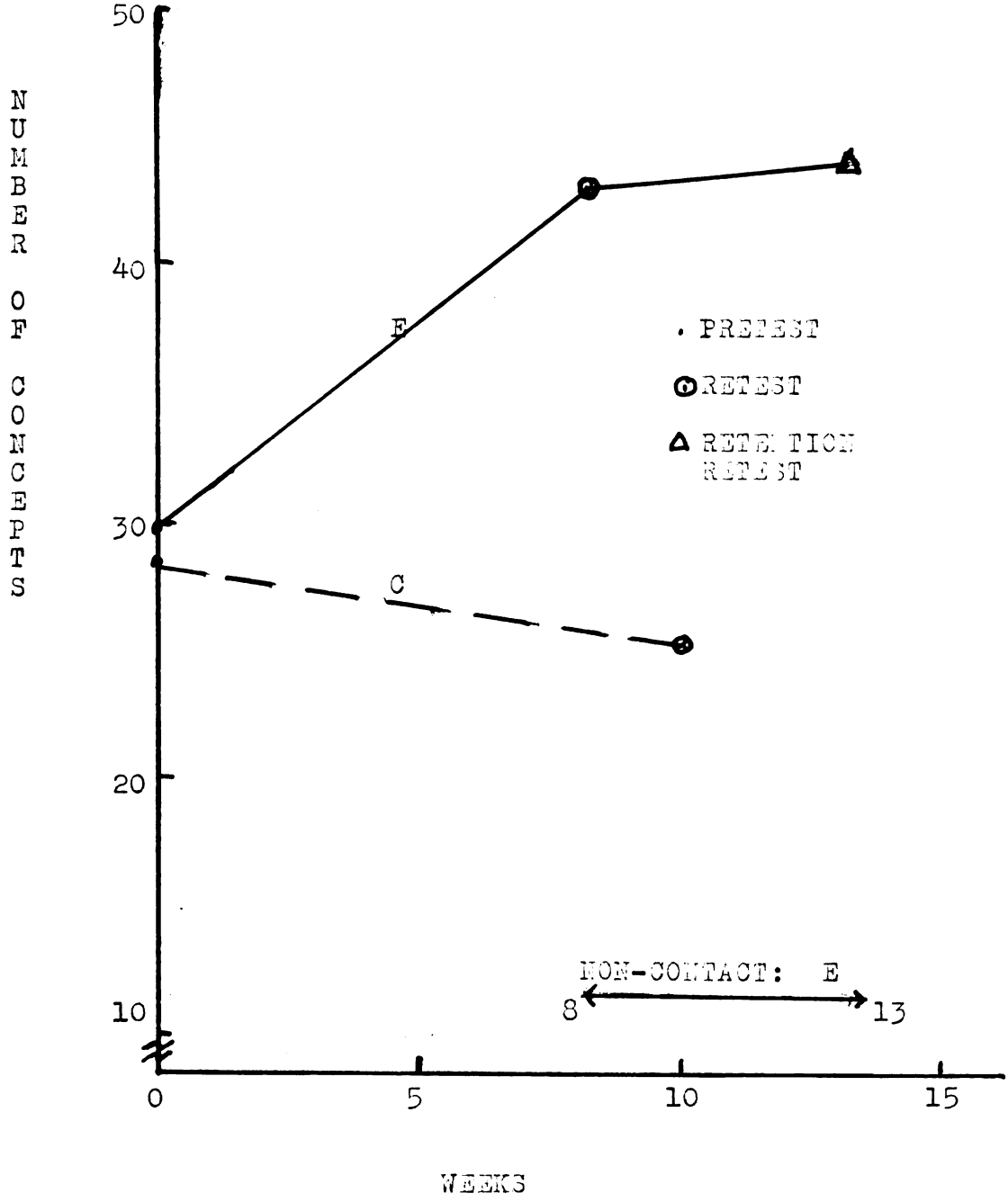

Figure 6. CONCEPT ACQUISITION AND RETENTION OF EXPERIMENTAL S 6 AND CONTROL S 12.

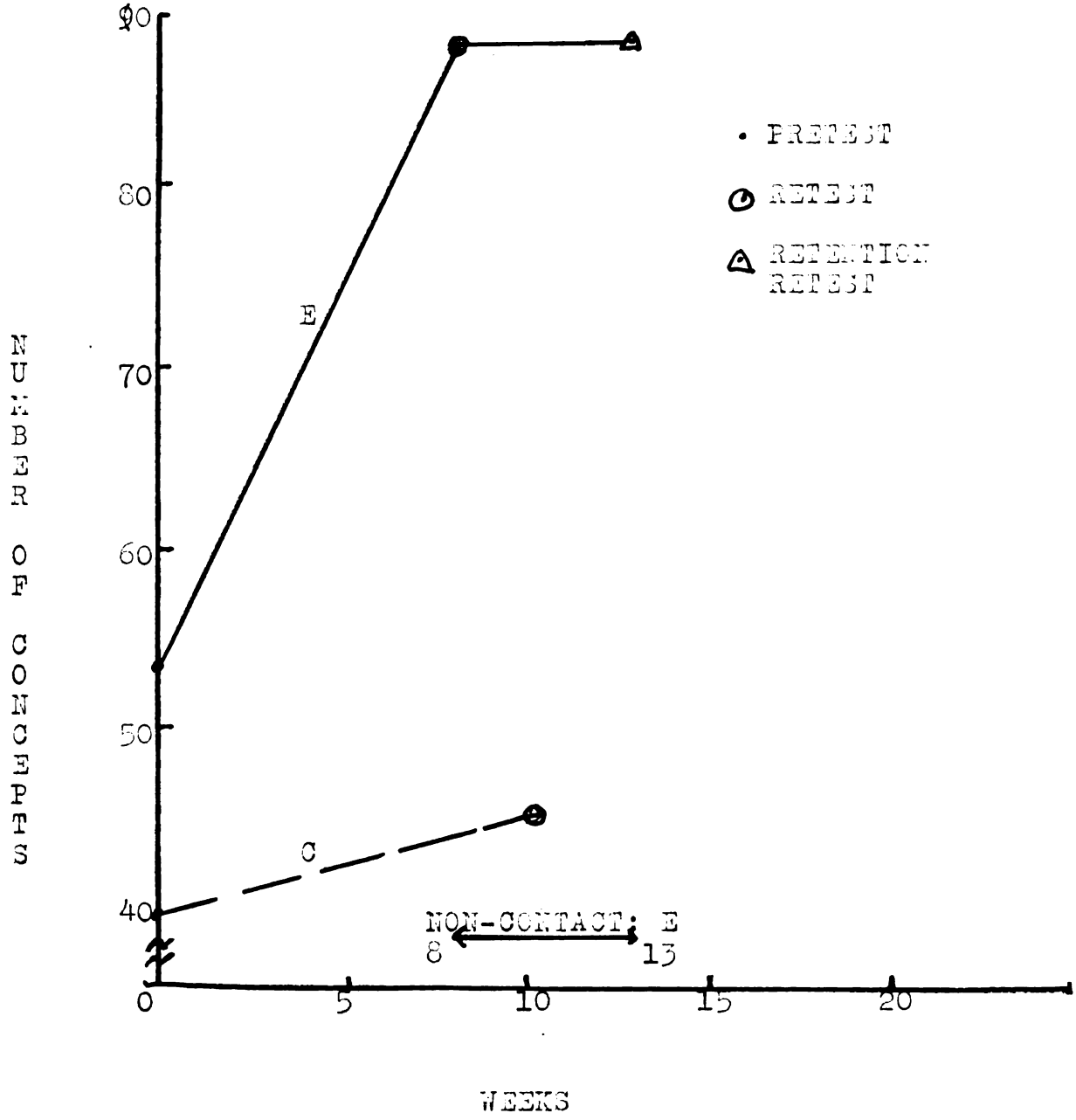

Figure 7. CONCEPT ACQUISITION AND RETENTION OF EXPERIMENTAL S 7 AND CONTROL S 11.

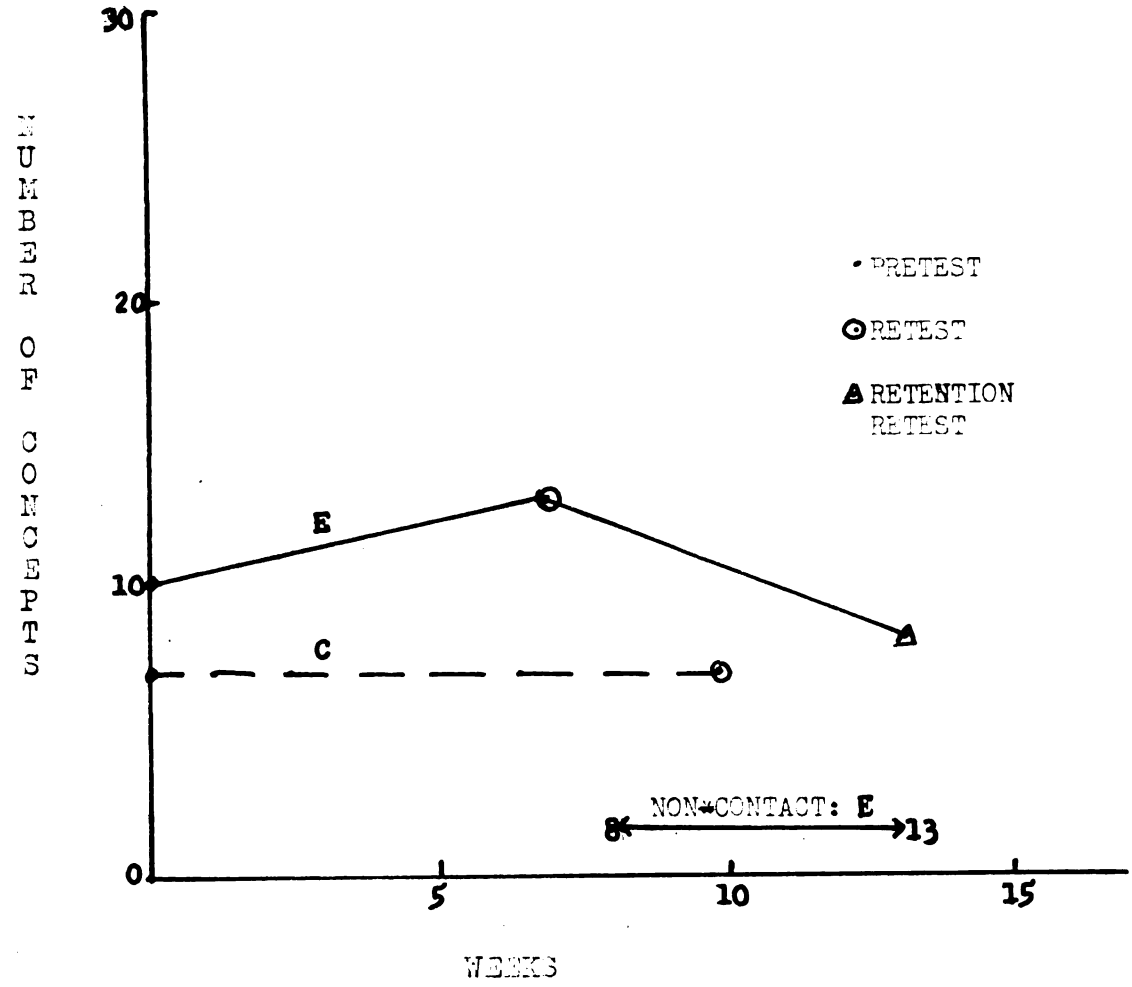

Figure 8. CONCEPT ACQUISITION AND RETENTION OF EXPERIMENTAL S 8 AND CONTROL S 14.

CHAPTER IV

DISCUSSION

The examples described above lend support to our premise that the severely retarded can learn, given the appropriate conditions. MUDRAFA and the methodology contained herein provide these conditions and bring the behavior of the subject under control of verbal commands in both verbal and non-verbal subjects. Thus, as in other studies (Ellis, Barnett, and Pryer, 1960; O'Connor and Hermelin, 1959) we find that the retarded subject can learn to use verbal mediators when trained to do so.

The results indicate that there is great intersubject variability in the concepts being mastered. Subjects with a high number of initial concepts known tended to show a steeper acquisition slope than those with a low number of initial concepts. However, there is no difference in retention of concepts once learned. This is similar to studies which compared normal and retarded subjects and found no evidence for a retention deficit (Ellis, Barnett, and Pryer, 1960; Wischner, Braun, and Patton, 1962).

Good learning and retention of reading is probably explained by the fact that this was a highly reinforcing behavior for the subjects. The mongoloid boy had previously been shown magazines with large colored pictures and had been

given magazines as reinforcers. The two non-verbal cerebral palsied spastics had been read to from children's books and had previously been told to lift their left hand when asked "Are you tired?". When reading was introduced they were told they would now be able to tell about themselves by reading a card and showing it to the experimenter. An important factor in learning was the sequential building of words and phrases which could be used by these subjects on the wards. Although retest and retention scores for further reading training are not available because of a quarantine in the hospital, inspection of daily records indicates that the acquisition and retention from day to day was even better than for other concepts.

The example of the highly distractible subject implies the possibility of increased learning by using a model in training.

Specific recommendations which may be made from the results of this study are:

1. Use a distraction free room so that attention is directed to the machine. Introduce new stimuli often to attract the subject's attention.

2. Although training is best approached as a game, it appears to be more reinforcing to call it going to school. The subject is often reinforced on the wards by the aides smiling and saying "Oh, Johnny's going to school now" or "What did you learn in school today, Diane?".

3. Be kind but firm. Use a positive approach. Keep

the situation pleasant but insure that the subject recognizes the concept as a command to which he is to respond.

4. Be an active participant yourself in training, make wide use of manual guidance and crutch cues. Later be an active observer-reinforcer.

5. Attempt to keep the subject active, do not allow him to get bored. Offer a variety of stimulus presentation and vocal commands.

6. Remember the characteristics of each child and consider his individual abilities and attention span. A given duration of experimental session may be appropriate for one child but not another, just as a certain reinforcer may be appropriate for one and not another.

7. Introduce new concepts before the subject becomes fatigued, remove the subject from the experimental room before he becomes fatigued.

8. Make available powerful and lasting reinforcers to elicit the behavior wanted.. Since the retarded subject tends to perseverate, it is important to specify and elicit the correct response. This is done by giving the reinforcer (tangible and social-verbal), a light for a correct response, saying "wrong" for errors, and prevention of incorrect responses by the use of barriers.

9. Make wide use of social-verbal reinforcement but do not use so much as to cause reinforcer intrusiveness. A simple statement such as "good girl" with appropriate intonation will suffice.

10. Progress slowly, offering familiar activities and using repetition across sessions and within sessions. This gives the subject an opportunity to receive reinforcement in performing something he knows well. Use repetition to build concepts on what the subject already knows.

11. Introduce the token system as soon as possible. This produced very little reinforcer intrusiveness and seems to specify the response as correct better than tangible reinforcers. The subject seems to anticipate receiving a reward for a stack of tokens and works without distraction to accumulate them.

12. Maximize generalization and transfer by varying the context in which the concept occurs. In the experimental session, vary the commands and their intonation. Rotate the board and change the stimuli and their position. Use the concepts outside of the experimental room as "go through the door."

13. Randomize the stimuli so that only one aspect (the concept) is consistently relevant over a series of like commands and all other possible cues such as position, shape, or size of slots do not act as relevant cues.

14. Talk to the subject even if he is non-verbal. Tell him in simple language throughout training what you are going to do. For example, in removing tokens you might say "Kathy you are so good we'll just have me and the light tell you when you're right or wrong. You can have a candy and ribbon when we're through."

15. Have the subject verbalize. Ask him questions. Shape his verbalization by reinforcing sounds at first and later reinforcing only progressively more suitable responses.

Future Directions A new MUDRAFA of basically the same design, but more compact and with a mechanized rotating front plate is now being constructed. The compact machine will be portable and thus can be taken to schools, homes, and bed patients. The automatically rotating face plate is circular and produces less distraction since the experimenter will no longer have to interrupt training to change orientation of the slots.

This new machine will be used with the subjects who are presently control subjects in this study. They will serve as their own controls since a baseline for number of concepts known has been established over time in interaction activity. This new study will also determine the effectiveness of training the subject to follow the activity of the experimenter and training to respond to the command "do this." It is assumed that imitation activity will facilitate learning and avoid the slow initial learning and short retention period.

Also, a study is presently being designed to use MUDRAFA with culturally retarded children. The children will be trained on basic geometric designs, numerousity, and reading. The control group of culturally retarded children will be matched on CA, MA, and pretest number of concepts. They will be trained individually by conven-

tional classroom methods. A retest on concepts and IQ test will determine the effectiveness of the two methods.

CHAPTER V

SUMMARY

This non-comparative study was undertaken to explore the practibility and possibility of training the severely retarded on prepositional and abstract concepts in response to verbal commands. Fourteen institutionalized severely retarded children and young adults served as subjects. Eight were trained on a Multiple Differential Response And Feedback Apparatus (MDRAFA) using a methodology which specified the deficits of the retarded subject and applied learning principles to overcome them.

It seemed that a high initial number of concepts known by pretest led to faster learning, but this made no appreciable difference in retention. Subjects with a low initial number of concepts retained as well as those with high initial number.

That subjects could learn to use verbal mediation is evidenced by the non-verbal subjects who were trained on reading. It was concluded that MDRAFA was effective in bringing the behavior of the retardate under the control of abstract verbal commands.

Specific recommendations concerning the use of MDRAFA and interaction with the child were given. Implications of this study for further learning research were also discussed.

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Pascalt

Concept Knowledge Test

APPENDIX A

GENERAL INFORMATION

Pre-test/re-test

Date started _____

Date finished _____

Subject's Name _____ Ward _____

Birth Date _____ Sex _____ Recorded CA _____ Recorded MA _____

Recorded I. Q. _____ Date I. Q. tested _____

Date institutionalized _____

Physical Condition

Spastic _____ (Type _____)

Ambulatory/non-ambulatory _____ (If non-ambulatory what are they in _____)

Verbal/Non-Verbal

Right/Left Handed

Medication Given _____ Type _____

In Speech Therapy _____

GENERAL COMMENTS (i.e. what nurse has to say about patient, or anything you notice that is pertinent to study)

Testee

DIRECTIONS:

1. Pre-test: Given in a room familiar to the subject (e.g., at [illegible] State Hospital—in the playroom) and while interacting with child on w[illegible] and from testing room (e.g.—push my hand, reach for my head).

2. Post-test: Given in experimental room [illegible] A ([illegible]) and while interacting as above.

3. Pre-select test items and testing stimuli from those in office. Return stimuli to proper slots when finished.

As usual keep room free of distractions.

Notation:

✓ indicates correct response

— indicates no knowledge of concept

Ø indicates physiologically impossible—in such a case another item similar to it must be made up, used, and listed in subject's test booklet.

Often subject's attention wanders or he is distracted and may tend to respond randomly. On a questionable response, return to that item after [illegible] other items.

Do not be rigid in the manner in which you test for the concept—the testing sheet is intended to be a guide. However, often the concept tested for (e.g. red) might include another concept (e.g. point to) which the subject does not know. In such a case, use another verbal (e.g., touch, [illegible], etc.).

4. Keep motivation high in testing: Reinforce subject verbally: "You're doing well!", "That's pretty good!", etc. in a random sequence. Variable ratio of 2 to 6 responses whether correct or incorrect and intermittently [illegible] tangible reinforcer ([illegible] etc.).

5. Test in random fashion: (e.g. 1a, 2a, 3a, . . . 62a; 1b, 2b, 3b, . . . 62b, 1d, 2d, 3d, . . . 62d).

TESTING

1. PUSH
   ____a. Push my hand
   ____b. Push the toy
   ____c. Push the chair
   ____d. Push the truck

2. PULL
   ____a. Pull my hand
   ____b. Pull the toy
   ____c. Pull the chair
   ____d. Pull the truck

3. REACH
   ____a. Reach for the dog (other is cat)
   ____b. Reach for the ball
   ____c. Reach for the block
   ____d. Reach for my head

4. POINT--(Have child use pointer from Machine)
   ____a. Point to the light
   ____b. Point to the dog (have 2 pictures on table--other is cat)
   ____c. Point to the ball
   ____d. Point to yourself

5. TOUCH
   ____a. Touch my hand
   ____b. Touch the table
   ____c. Touch your eye
   ____d. Touch the toy

6. STOP
   ____a. Have walking subject stop
   ____b. Stop rotating wheel
   ____c. Stop rolling ball
   ____d. Have subject pushing truck and tell him stop

7. GO
   ____a. Have stopped subject go
   ____b. Make wheel go
   ____c. Make ball go
   ____d. Make truck go

8. DON'T/DO NOT
   ____a. Have subject playing with doll and then say don't play
   ____b. Have subject walking and then tell him don't walk
   ____c. Have subject eating marshmallows and then say "don't eat"
   ____d. Have subject scribbling on paper and then tell him "don't write"

9. UP
   ____a. Look up
   ____b. Stand up
   ____c. Put hand up
   ____d. Put this toy up

10. DOWN

_____a. Look down
_____b. Sit down
_____c. Put hand down
_____d. Put toy down

11. Rough

_____a.
_____b.
_____c.
_____d.

12. SMOOTH

_____a. Pick out difference between rough and smooth sandpaper
_____b. Bristly pipe cleaner versus plain pipe cleaner
_____c. Glass versus sandpaper
_____d. Rough block/smooth block

13. BIG

_____a.
_____b.
_____c.
_____d.

14. MEDIUM

_____a.
_____b.
_____c.
_____d.

15. LITTLE

_____a. Pick out big/medium/little pencil
_____b. Big/medium/little bottles
_____c. Which box is big/medium/little
_____d. Which block is big/medium/little

16. SHORT

_____a.
_____b.
_____c.
_____d.

17. LONG

_____a. Pick out the short/long pencil
_____b. Short/long wire
_____c. Which piece of paper is short/long
_____d. Which pipe cleaner is short/long

18. THICK

_____a.
_____b.
_____c.
_____d.

19. THIN

_____a. Pick out the thick/thin pencil
_____b. Pick out the thick/thin block
_____c. Pick out the thick/thin lines (on paper)
_____d. Thick versus thin cardboard strips

20. STRAIGHT

_____a.
_____b.
_____c.
_____d.

21. CROOKED

_____a. Pick out straight pipe cleaner from crooked pipe cleaner (making sure pipe cleaner is crooked not curved)
_____b. Straight versus crooked lines on paper
_____c. Straight versus crooked cut out pieces of paper
_____d. Straight versus crooked wire

22. IN

_____a.
_____b.
_____c.
_____d.

23. OUT

_____a. Have subject placed so that the opening of a box is away from him. Tell subject to place object in/or to take object out of the box.
_____b. Go out/in room
_____c. Put object in/take object out of wastebasket
_____d. Put pencil in my hand--take it out of my hand

24. CURVED

_____a.
_____b.
_____c.
_____d.

25. STRAIGHT

_____a. Pick out straight pipe cleaner from curved pipe cleaner (making sure pipe cleaner is curved not crooked)
_____b. Straight versus curved lines on paper
_____c. Straight versus curved cut-out pieces of paper
_____d. Straight wire versus curved wire

26. UNDER
____a.
____b.
____c.
____d.

27. OVER
____a. Put toy under/over the box
____b. Place your hand over/under my hand
____c. Put toy under/over the table
____d. Put doll over/under the chair

28. BEHIND
____a.
____b.
____c.
____d.

29. IN FRONT OF
____a. Put toy in front of/behind box
____b. Go in front of me/behind me
____c. Put your hand in front of/behind you
____d. Put your toy in front of/behind other toy

30. THROUGH
____a. Poke your finger through this piece of paper
____b. Put your finger through the hole
____c. Come through the door way
____d. Push the marble through the tube

31. BETWEEN
____a. Put your hand between my hands
____b. Push the toy between those two blocks
____c. Walk between the chair and the table
____d. Walk between me and the wall

32. NEXT TO
____a. Stand next to the table
____b. Go next to the table
____c. Place your hand next to my hand
____d. Place toy next to other toy

33-38. COLORS
Spread out red, blue, yellow, green, white, black to begin with
____a. Circles, have subject then go on to picking out single colors
____b. Squares
____c. Have subject pick out various colored objects in the room or outside
____d. Have subject pick out colors that he/she is wearing (name them for him)

33. RED ____ 34. BLUE ____ 35. YELLOW ____ 36. GREEN ____
37. WHITE ____ 38. BLACK ____

39. ROUND
____a.
____b.
____c.
____d.

40. SQUARE
____a.
____b.
____c.
____d.

41. TRIANGLE
____a. Picture of circle versus picture of square
____b. Round mirror versus square
____c. Ball versus block
____d. Round cardboard versus square cardboard

42. SOFT
____a.
____b.
____c.
____d.

43. HARD
____a. Soft sponge versus hard sponge
____b. Soft yarn ball versus hard ball
____c. Soft "square" versus hard "square"
____d. Soft "circle" versus hard "circle"

45. IN 46. FULL

____a. ____a. Two cups--one full, one empty. Have subject pick out full/empty one

____b. ____b. Two toy boxes--one full, one empty. Have subject pick out full/empty one

____c. ____c. Two toy cars--one full, one empty. Have subject pick out full/empty one

____d. ____d. Two hands--one full, one empty. Pick out full/empty one

46. TO

____a. Take me to the window

____b. Go to the door

____c. Bring the toy to me

____d. Push the toy to me

47. ON 48. OFF

____a. ____a. Put your hand on the table--take it off the table

____b. ____b. Take the toy off the table

____c. ____c. Place the toy on the table

____d. ____d. Put the hat on/off your head

49. EATING 50. DRINKING

____a. ____a. Have subject pick out correct pictures of utensils for eating/drinking

____b. ____b. Have subject pick out pictures of people eating/drinking

____c. ____c. Have subject pick out objects that either have to be eaten or drunk (marshmallow vs. drink of water)

____d. ____d. Plate, fork, cup--Which do you eat/drink with?

51. WALKING 52. RUNNING 53. JUMPING

____a,b. ____a,b. ____a,b. Instruct subject to do each of these:

Run____ Walk____ Jump____

____c,d. ____c,d. ____c,d. Have subject pick out pictures of people doing each of these:

Run____ Walk____ Jump____

54. SITTING 55. STANDING

		Sitting	Standing
____a,b.	____a,b. Same as above	____	____
____c,d.	____c,d. Same as above	____	____

56. ASLEEP 57. AWAKE

		Asleep	Awake
____a,b.	____a,b. Same as above	____	____
____c,d.	____c,d. Same as above	____	____

58. TURN

____a. Turn around

____b. Turn the toy

____c. Turn the crank

____d. Turn the chair to the window

59. LEFT 60. RIGHT

____a. ____a. Raise your left/right hand.

____b. ____b. Turn left/right

____c. ____c. Pick up the toy one the left/right

____d. ____d. Put the toy on your left/right

Appendix B

Sex, Chronological Age, Mental Age, IQ, and Etiology of Retardation For Experimental and Control Subjects

Subject	Sex	CA in Years & Months	MA in Years & Months	IQ	Etiology
Experimental:					
1	F	33-0	3-7	11	congenital cerebral palsy
2	M	5-6	0-7	11	encephalopathy
3	M	13-2	3-0	15	mongolism
4	M	12-1	2-3	19	anoxia at birth
5	F	13-2	2-5	18	developmental cranial anamoly
6	M	29-0	4-3	14	congenital cerebral palsy
7	M	15-6	3-5	26	congenital cerebral palsy
8	M	13-3	2-6	20	mongolism
Control:					
9	M	6-3	0-8	11	encephalopathy
10	F	17-7	2-11	16	hydrocephalus, arrested
11	M	19-4	3-0	15	encephalopathy due to syphillitic (prenatal) infection
12	M	17-5	2-6	15	undifferentiated
13	F	17-9	2-8	15	erythoblastosis fetalis
14	M	15-0	2-2	16	congenital cerebral palsy

Appendix C

Concept Knowledge Scores For Each Subject on Pretest and Retests

Experimental Group I:

Subject	Pretest Score	Training Span	Retest Score	Training Span	Retest Score	Non-Contact Span	Retention Retest Score
1	45	10 wks.	61	8 wks.	98	5 wks.	97
2	1	" "	10	" "	12	" "	10
3	29	" "	55	" "	62	" "	64
4	19	" "	29	" "	38	" "	39

Experimental Group II:

Subject	Pretest Score	Training Span	Retest Score	Non-Contact Span	Retention Retest Score
5	3	8 wks.	6	5 wks.	6
6	26	" "	43	" "	49
7	54	" "	88	" "	88
8	10	" "	13	" "	8

Control Group:

Subject	Pretest Score	Interaction Span	Retest Score
9	1	10 wks.	0
10	21	" "	21
11	40	" "	45
12	28	" "	25
13	2	" "	1
14	7	" "	7