IMITATION LEARNING IN THE SEVERELY RETARDED

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ABSTRACT

IMITATION LEARNING IN THE SEVERELY RETARDED

by Jo Ann Sinclair

Severely retarded children, whose verbal skills are generally inferior to those of normal children of comparable mental age, have an especially difficult time learning prepositional concepts such as _through_ and _around_. It has been demonstrated that severely retarded youngsters are able to learn a variety of concepts on a teaching machine, the Multiple Differential Response and Feedback Apparatus (MUDRAFA).

The present study investigated the efficacy of modeling, using MUDRAFA, to increase the rate of acquisition of concepts. The study also investigated the value of rewarding _S_s for observing a model, as well as the effect of praise in addition to primary and secondary reinforcement.

Four groups of 10 severely retarded male _S_s (CA 11-32) were trained on prepositional concepts. Two groups observed a model "learn" each concept (38 trials). One group was given primary reinforcement (sugared cereal) each time the model made a correct response, the second group merely observed. A third group observed no model,

but was the only group praised after each correct response. The fourth group was the control.

All groups were rewarded with cereal during the first 38 acquisition trials after which the reward was tokens to be exchanged for cereal (FR 5:1). Correct responses were signalled by a light and buzzer. Incorrect responses were signalled by E's saying, "No, that's wrong." The correction method was used when errors were made.

Three hypotheses were tested. The first was: Severely retarded Ss who observe a model "learn" a concept learn the same concept in fewer trials than those who observe no model. This hypothesis was not supported. However, there was a nonsignificant trend in the predicted direction. Post hoc analyses indicated Group I was not significantly different from Group IV (control) in trials to learn, while Group II (not reinforced for observing) was significantly superior to Group IV. Differences between Groups I and II approached significance, thus, when the two model groups were combined for comparison with the combined no-model groups, any superiority that modeling might have had was clouded by the inferiority of Group I.

The second hypothesis was: Ss who are reinforced for observing a model learn in fewer trials than those who are not reinforced for observing. This was not supported.

Indeed, the results were in the opposite direction, and the difference between the two groups approached significance. This suggested that reinforcing a S for observing a model interferes with attending to relevant cues in the modeling situation.

The third hypothesis was: Ss who receive primary verbal reinforcement (praise) in addition to primary, secondary, and negative verbal reinforcement do not differ in trials to learn concepts on MUDRAFA from those who are not given positive verbal reinforcement. The null hypothesis could not be rejected. However, post hoc analyses indicate that Group III (Praise) did not differ from the two model groups on those concepts which appeared to be easier to learn, but were inferior to the model groups on the apparently more difficult concepts. It was suggested that praise combined with modeling might be additive.

All Ss were tested for their knowledge of the experimental concepts prior to training and after training in a real-life situation. They were also tested for retention four to six weeks after the conclusion of training. Scores of all Ss were combined. Significant differences were found between pretest and posttest scores and between pretest and retention test scores. Posttest and retention test scores did not differ. The results suggest that Ss from all groups learned.

It was concluded that MUDRAFA has: (1) potential for training the severely retarded; and (2) pronounced research capabilities.

Approved: ______________________________

Date: ___________________________________

IMITATION LEARNING IN THE SEVERELY RETARDED

By

Jo Ann Sinclair

A THESIS

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This thesis is dedicated to

Dr. S. G. Armitage

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INTRODUCTION

Severely and profoundly retarded children, whose verbal skills are generally inferior to those of normal children of comparable mental age, appear to have an especially difficult time learning prepositional concepts such as _through_ and _around_ (Denny, 1966). Understanding such concepts should help the retarded child respond more adequately to instructions, and thus facilitate his learning skills such as feeding, dressing, simple chores, and games requiring motor skills. This study investigated the effects of imitation, or use of a model, as well as the effect of verbal reward (praise), paired with primary reward, on the learning of prepositional concepts by severely and profoundly retarded boys and young men.

Denny (1966) and his students have demonstrated that severely retarded youngsters are able to learn a wide variety of concepts from the simple concepts _up-down_ to more complex prepositional concepts such as _through_ and _around_ on the Multiple Differential Response And Feedback Apparatus (MUDRAFA). Yascolt (1966) trained 14 _Ss_, CA 5 to 33 years, MA 7 to 51 months, IQ 11 to 26, on MUDRAFA. A variety of reinforcers (candy, trinkets, play money, tokens) were given each _S_. The _Ss_ were first trained on _up_, _down_, _right_, _left_, then went to other abstract and prepositional concepts. Three advanced Ss were then trained on numerosity, then letters, and finally words and sentences. Yascolt found that Ss who knew a greater number of concepts initially tended to show a steeper acquisition slope than those who knew fewer concepts initially, but there was no difference in retention once the concepts were learned.

This research by Denny (1966) and Yascolt (1966) demonstrated that "non-trainable" (IQ below 30), severely and even profoundly retarded children and adults can learn many things hitherto thought impossible. The method employed, however, is costly in terms of time since each child is trained individually. If it can be demonstrated that the use of a model facilitates learning on MUDRAFA with an individual, then it may be possible to train groups using the same technique.

Miller and Dollard, in their classic Social Learning and Imitation (1941), give ample evidence that humans and animals as low in the phylogenetic scale as the rat can and do learn to imitate, given appropriate environmental conditions, and that imitation will generalize, that is, be elicited under similar conditions.

Rosenblith (1959) had kindergarten children observe a model correctly perform on mazes the younsters had previously failed and found that this group performed more effectively than those who merely were given additional trials. In a discrimination study with preschool children, CA 3-7 to 4-10, median IQ 130, Wilson (1958) found that the group which observed a model in pretraining learned in significantly fewer trials than the control, and made significantly fewer errors. When pretraining trials were added to acquisition trials, there was no significant difference. However, no instructions were given the experimental group, thus indicating that incidental learning had occurred. If errors are costly, the study does suggest that imitation is more efficient.

Bandura and Walters (1963) have demonstrated, experimentally, the truism that children imitate behaviors of others in a social setting, sometimes deliberately, apparently at other times incidentally. Retarded children seem to have an incidental learning deficit (Denny, 1964) which appears to be a consequence of a basic attention deficit (Zeaman & House, 1958). Therefore, the retarded child may not learn by imitation, either deliberate or incidental, in the home or institution. However, in a controlled environment, imitation of a model may be elicited if attending were guided and intentional, conditions which Benoit (1957) considers to be of great importance if the retarded are to learn at all.

Normal children watch those around them and initiate behaviors from gross body movements to finer muscle movements. A child appears to learn incidentally a large number of simple behaviors which serve as a basis for learning increasingly more complex behaviors. In an intentional learning situation, he is frequently guided to attend to relevant cues by verbal means. If imitation is to be elicited from the mentally retarded child with his poor verbal skills and attention deficit, an intentional learning-to-imitate situation may have to be designed for each behavior to be learned. Relevant cues must be made to stand out, and attention guided toward them. At the same time, irrelevant cues must be reduced. Guiding can include turning the child's head toward the cue, pointing to it, and making the cue distinctly different from its background. Verbal cues must be distinct if the retarded child is to respond to the relevant words in instructions or commands.

A number of studies have found that praise facilitates learning. Hurlock, in 1925, found that for fourth and fifth graders, when reinforced for school work before the peer group, praise (verbal reward) was the most effective reinforcer, then reproof, while the least effective condition was ignoring the child. Kennedy, Turner, and Lindner (1962) found no difference in the effectiveness of praise and reproof for bright (IQ 124-150) 11th and 12th graders, but reproof created a decrement in the average S (IQ 95-116). Willicutt and Kennedy (1963) studied the relation of intelligence to the effectiveness of praise, reproof, and no incentive (no knowledge of results) and found no relationship between intelligence and incentive, but praise was more effective for all IQ groups. Zigler, Hodgden, and Stevenson (1958) compared normal and mentally retarded children of approximately equal MA (5.8-6.2) on verbal support and nonsupport. The mentally retarded support group spent a longer period on the task (playing games) than the nonsupport group, but they were more variable than their normal counterparts.

Ellis and Distefano (1955) in a rotary pursuit study found that urging and praise facilitated performance by the mentally retarded, IQ approximately 52. Terrell and Kennedy (1957) found reproof the least effective incentive in a discrimination task with four- and five-year olds and eight- and nine-year olds, but found no significant difference between praise and tokens as elicitors. Using a counterbalanced design, Stevenson and Snyder (1960) used verbal reward, punishment, and neutral conditions in two simple games with mentally retarded Ss (mean MA 6.5, mean CA 13.5) and found that the reward condition in the first game did not elicit a performance superior to that in the neutral condition, but punishment suppressed performance in both games, even following the neutral condition.

Meyer and Seidman (1960) found nonsignificant trends in verbal reinforcement effectiveness dependent on age. With preschoolers, aged four and five, the order of effectiveness (from most to least effective) was "right"-"wrong," buzzer-nothing, nothing-"wrong," and "right"-

nothing, while with older children aged eight and nine, the order was nothing-"wrong," "right"-"wrong," buzzer-nothing, and "right"-nothing. Although differences were not significant, the authors concluded that punishment serves to increase drive in older children. Sullivan (1964) used verbal reward and punishment with 5, 7, 9, and 11-year olds in a simple discrimination problem and found that reward was not effective at age five, but the effectiveness of verbal reward increased with increasing age. Punishment was superior to verbal reward at all age levels, and verbal reward and punishment used in combination were additive. Curry (1960), working with elementary school children, found no significant difference between "right"-"wrong" and nothing-"wrong," but both were superior to "right"-nothing. Matsuda and Matsuda (1966) found that normal kindergarten children and mentally retarded children learned a simple discrimination best under a nothing-"wrong" condition, while third graders learned best under "right"-nothing. Doty, Neuman, and Prucha (1967) reinforced 4, 7, and 10-year olds with "right" or "wrong," by allowing them to look at a colored picture, or by allowing them to operate a machine to change stimuli. Verbal reinforcement was best only for 10-year old girls. Visual exploration and manipulation were significantly better elicitors for boys and four and seven-year old girls.

Other studies suggest that tangible rewards are as good or better than verbal rewards. Risley (1966) found in working with echolalic children that the rate of response dropped significantly when primary rewards were eliminated and only verbal reinforcement was given for appropriate speech. Zigler and deLabry (1962) found that familial retardates and lower-class normal children learned a concept switching task faster for toys than middle-class children, but there was no difference between the groups when the optimal reinforcement, toys for retardates and lower-class children, and verbal reward for middle-class children, was given each group.

Terrell and Kennedy (1957), working with four and five-year olds and eight and nine-year olds, found that candy was a significantly better reinforcer than praise, but there were no significant differences between praise, tokens, or a light indicating knowledge of results. Reproof was the least effective elicitor. Mentally retarded S's, MA 3.0 to 7.1, performed significantly better on a pursuit rotor for candy than for praise. Newman (1966) in a concept-switching experiment with retarded boys (IQ 52-75) found only limited support for the hypothesis that verbal reinforcement is superior to nonsocial reinforcement (red checks for right, X's for wrong).

The studies reviewed above do little to clarify the issue of which reinforcers are most efficacious for the groups studied, and they offer no clues for selecting reinforcers for the severely and profoundly retarded. Table 1 summarizes differences in reinforcer effectiveness, but the populations studied vary so greatly that one cannot generalize from the studies. It may be that Yascolt's (1966) use of a variety of reinforcers, including verbal, elicits the most consistent responses, and that the comparative psychologist's injunction to "know your animal" should be followed with individual human Ss or students in terms of reinforcers when training.

Satiation can become a problem when primary reinforcement is given, but rewarding with tokens to be exchanged for primary reward may delay satiation. Both Denny (1966) and Yascolt (1966) rewarded Ss with tokens which were exchanged for primary rewards or valued trinkets, and other studies suggest tokens are reinforcing (Wolfensberger, 1960; Ellis & Pryer, 1958; Terrell & Kennedy, 1957; Newman, 1966).

In the present study, many of the recommendations for procedure outlined by Denny (1966) and Yascolt (1966) were incorporated, such as making the experimental room as distraction-free as possible, not allowing Ss to become tired or bored, using the correction method, making certain the child knows if he performed correctly or incorrectly on each trial, and making certain commands were not ambiguous. Previous studies, however, have tailored the

TABLE 1.--Comparison of Reinforcement Superiority in Published Studies*

	No. of studies yielding significant differences or trends
Praise > punishment	6
Praise > neutral	2
Neutral > punishment	2
Punishment > neutral	1
Right-wrong > right-neutral	3
Right-wrong > signal-neutral	2
Right-wrong > neutral-wrong	1
Neutral-wrong > right-wrong	1
Right-neutral > neutral-wrong	1
Neutral-wrong > right-neutral	4
Signal-neutral > neutral-wrong	1
Neutral-wrong > signal-neutral	1
Visual exploration > right-wrong	1
Tangible > praise	4
Praise > tangible	1

*> means more effective

teaching of concepts to the individual, that is, types of reinforcement have been varied both between and within Ss with the assumption that praise and verbal support are positively reinforcing, and no attempt has been made to standardize the teaching of concepts in terms of number of trials, kinds of trials, treatment of errors, and other procedures on the MUDRAFA. The present study was also among the first to investigate, in the severely retarded, the relative effects on learning, of primary reinforcement, a model, and primary reinforcement for observing a model.

Problem. The principal questions which we attempted to answer in this study were: Do retarded children who observe a model "learn" a concept acquire the concept as quickly as children who observe no model, but are trained from the outset on MUDRAFA? Can severely and profoundly retarded children who are posited to exhibit an inhibition deficit, including, according to Denny (1964), an inability to maintain an orientation for stimuli, be induced to attend to a model at all?

Both Denny (1966) and Yascolt (1966) listed a number of recommendations for procedure which, while appearing intuitively sound, have not been systematically investigated. One of these was the use of a variety of reinforcers, including praise, and signaling correct responses by a light and buzzer. Withholding the light, buzzer, and tangible reinforcement and saying, "No, that's wrong" signaled errors. Thus a secondary consideration of this study was the effect of positive verbal reinforcement (praise) when added to primary, secondary, and negative verbal reinforcement, on acquisition.

Hypotheses. The first hypothesis was: Severely retarded Ss who observe a model "learn" a concept learn the same concept in fewer trials than those who do not observe a model. A model is defined as one who demonstrates the appropriate motor act on MUDRAFA in response to commands.

The rationale was based on studies of imitation (Dollard & Miller, 1941; Bandura & Walters, 1963) and on observations of institutionalized severely and profoundly retarded persons. The writer tested and worked with 75 retardates of this level, age 6 to 16, over a period of several months and found that 75% of this sample had no speech at all, and the remainder had extremely limited speech, consisting primarily of single words. They responded only to simple commands such as "Stand up" or "Sit down." It appeared that they responded to the word stand alone, or to the phrase, but did not appear to understand the concept up in another context. Many would imitate simple behaviors which, when paired with commands, could be later elicited by commands alone in another context. For example, if E demonstrated (modeled) putting a ball under a chair, the child would imitate E, but the modeling situation had to be structured. The cue word under was stressed in the sentence "I put the ball under the chair" just prior to the act and repeated while the ball was there. Usually several demonstrations were necessary. Frequently E found it necessary to place the ball in the child's hand and guide it under the chair while giving the command. Once the concept was understood in one context, it usually generalized to others and S would respond appropriately to the commands "Put the ball under the box" and "Put the box under the table."

The second hypothesis was: Ss who are reinforced for observing a model learn in fewer trials than those who are not reinforced for observing. This hypothesis evolved from the evidence for a basic attention deficit (Zeaman & House, 1963) and therefore an incidental learning deficit discussed by Denny (1964). If a model is to facilitate learning, the S must attend to the model. Observation indicates that the severely retarded will attend to a model in a structured situation, but if attending were reinforced, more consistent attending might be elicited, leading to more rapid learning.

The third hypothesis was: Ss who receive positive verbal reinforcement (praise) in addition to primary, secondary, and negative verbal reinforcement do not differ in trials to learn concepts on MUDRAFA from those who are not given positive verbal reinforcement. This final hypothesis evolved primarily from observation of severely retarded in their relationships with ward staff who frequently appeared to be free with negative verbalization. Commands were usually given in loud, harsh tones. When the child responded appropriately, it was infrequent that he was rewarded with praise or a hug. This behavior was not exhibited by all staff or constantly by any one member, but it did appear to be the major method of control. In a one-to-one relationship with E, praise seldom elicited the desired behavior, but crackers and candy frequently did. A few children who experienced frequent praise paired with primary reinforcement eventually responded to praise alone.

METHOD

Subjects. The 40 *Ss* for this research project were selected from the population of the Fort Custer State Home in Augusta, Michigan, according to the following criteria: (1) all were diagnosed as severely retarded, the diagnosis supported by the Peabody Picture Vocabulary Test (see Appendix B for MA and IQ scores); (2) all were between the ages of 11 and 32; (3) all possessed the ability to imitate simple behavioral acts; and (4) all lacked knowledge of 8 out of 12 experimental concepts which were *up*, *down*, *right*, *left*, *push*, *pull*, *long*, *short*, *over*, *under*, *between*, and *beside*. All except the last two concepts were actually paired and opposite, such as *up* and *down*.

The criterion for imitation noted above consisted of the *S*'s capability to imitate, on command, four out of six simple behavioral acts such as clapping hands, stamping feet, or slapping thighs.

Those who demonstrated the capability to imitate were then tested on the 12 crucial concepts. For this purpose a modification of Yascolt's (1966) concept knowledge test was employed (Appendix A). The *S* was required to respond to commands employing the experimental concepts in a real-life situation, e.g., "Put the ball *under* the chair," "Give me the car on your left," or "Give me the short pencil." A concept was considered to be understood if a correct response was elicited three out of four times.

The 40 Ss so selected were randomly assigned to three experimental and one control group of equal size (see Table 2).

Apparatus. The apparatus was an adaptation of MUDRAFA used by Denny (1966) and Yascolt (1966), modified by Dr. Stewart G. Armitage (Figure 1). In the vertical front panel of the box-like structure was an aluminum disc which could be rotated or locked in place. Centered in the disc was a cross-shaped aperture with slots of varying width and length. These were positioned so that a long slot was opposite a short one, a wide slot opposite a narrow one. Extending through the center of the cross was a hollow rod mounted on the rear panel of the box which could be moved in any direction by means of a universal joint. Mounted at the free end of the rod was a translucent handle which enclosed a green light. This could be controlled by a foot pedal switch and when lighted signaled a correct response. This was supplemented by a buzzer. At the end of each slot was mounted a frame in which could be inserted a specific stimulus. Stimuli could also be mounted at the sides of slots by double-stick tape or Tacki Wax. All slots could be closed with plastic barriers which locked in place. A manually operated reinforcement dispenser

TABLE 2.--Reinforcement Conditions during Observation and Acquisition Under Modeling and No-Modeling Conditions

Group	Observation	Acquisition
I	light buzzer cereal (first concept only) tokens (S accumulated 5 to be exchanged for cereal on subsequent concepts)	light buzzer cereal (initial 38 trials on first concept only) tokens (5:1 ratio as in observation on subsequent concepts) "No, that's wrong" when error occurred
II	light buzzer	light buzzer cereal (initial 38 trials on first concept only) tokens (5:1 ratio as above) "No, that's wrong"
III		light buzzer cereal (initial 38 trials on first concept only) tokens (5:1 ratio as above) praise "No, that's wrong"
IV		light buzzer cereal (initial 38 trials on first concept only) tokens (5:1 ratio as above) "No, that's wrong"

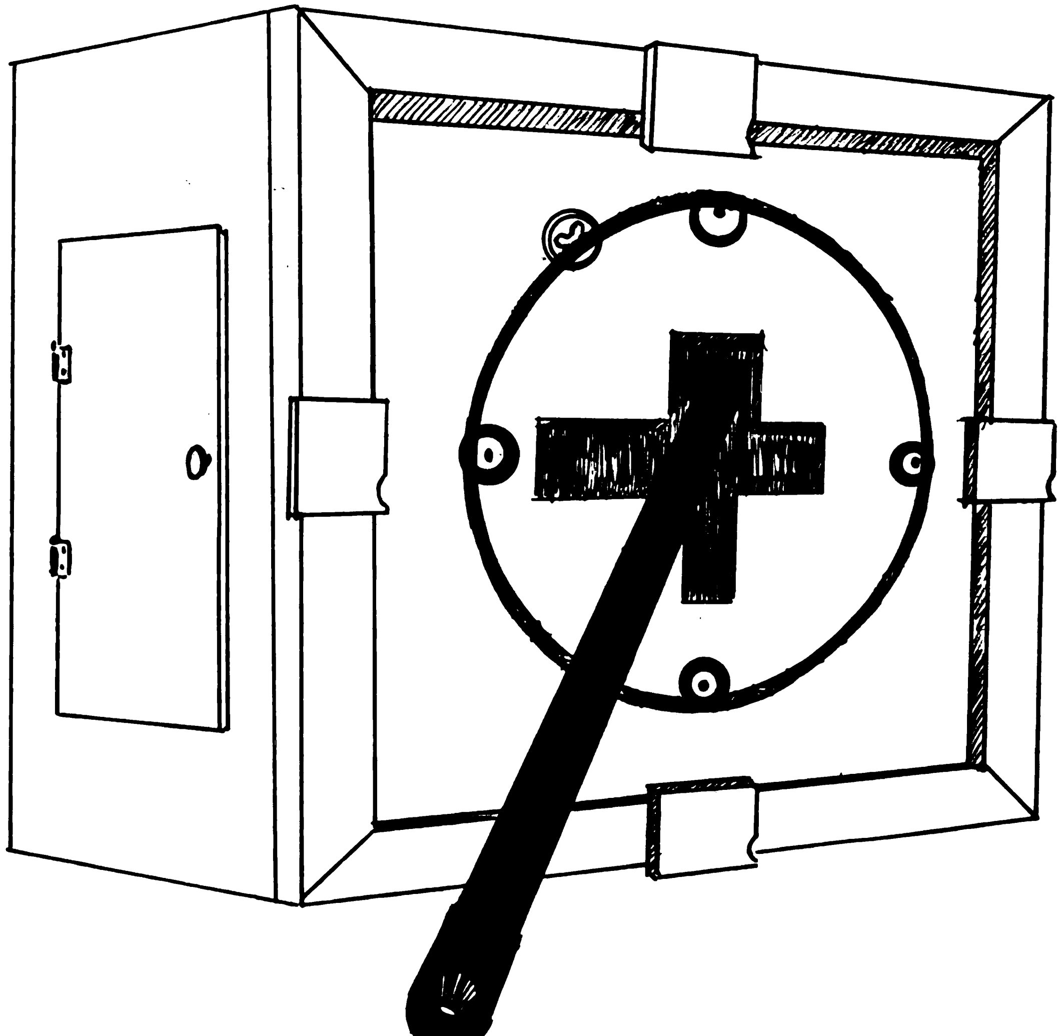

Figure 1. Multiple Differential Response And Feedback Apparatus (MUDRAFA).

was attached to the bottom left side of the box, but in this experiment reinforcements were handed directly to the Ss.

Stimuli. Stimuli were visual cues which were placed on the face of the apparatus in order for the S to have something to place the rod over, under, beside, or between. The stimuli were selected on the basis of pictures recognized on the Peabody. The most frequently identified objects were a car (28 Ss made correct identifications) and a shoe (24 identifications). Line drawings of these objects similar to those on the Peabody were made on small cards and these, in conjunction with opaque blue plastic squares (identical in size with the drawings), comprised the stimuli for the concepts over, under, between, and beside. However, the mortality rate for the drawings consequent to biting and tearing was so great that they were abandoned and the blue plastic squares, which proved to be as effective as the drawings, were used exclusively.

Procedure. On every trial for which stimuli were necessary, the stimuli were placed on the face of the apparatus adjacent to each slot, but with only one correct response possible. Each S was trained on two single and two paired concepts, the former being beside and between. If a S had demonstrated prior knowledge of beside and between, one of a pair with which he was unfamiliar (usually over or under) was treated as if it were single.

All Ss were first trained on the paired and then on the single concepts.

Groups I and II (experimental) observed a model-experimenter "learn" a concept. Before moving the rod, E drew S's attention by tapping the disc and saying "Watch." The model (M) made only correct responses, and each time a response was made, the light went on and the buzzer sounded. After the first six trials, the face of the apparatus was rotated or stimuli changed to position II and M made two more responses. For the first block of eight trials, no errors were possible, for only the correct slot was open. Immediately after observing M for eight trials, S was permitted to use or manipulate the apparatus for eight acquisition trials with conditions identical to those he had just observed. Following the first eight acquisition trials, M returned to the apparatus and continued "learning" the concept in blocks of trials (six or eight, see below), followed by S on the apparatus after each block. Additional slots were systematically opened and the face of the apparatus rotated or stimuli changed to prevent the learning of irrelevant cues until all slots were open and all positions of the disc or the stimuli had been presented. The first three blocks of trials comprised eight trials each, for both model and subject, but the fourth block comprised only six trials since, in that block, all four slots were open, and all positions of the face had been presented. The first four blocks of trials thus consisted of a total of 30 trials, after which M concluded his "learning" with all slots open and the face of the apparatus randomly rotated or stimuli changed to each position twice, followed by S on the apparatus for eight trials, for a total of 38 trials.

After 38 trials, acquisition continued until the following criterion was met: 10 consecutive correct responses with all slots open. The correction method was used for all trials. When an error was made, E said, "No, that's wrong," and S was allowed to correct his response. After the initial 38 trials, when two consecutive errors were made, one slot was closed, the one most likely to be entered. For example, some Ss had position preferences, so the slot in the preferred position was closed. Some tended to enter the previously correct slot, so that one was closed. If five correct trials followed closing a slot, it was reopened. If S continued to make errors, more slots were closed and gradually reopened until four again were open.

If a S did not reach criterion on a concept in 450 trials, training was stopped on that concept and he was credited with 451 trials for statistical purposes. For double concepts, such as up-down, a maximum of 450 trials was allowed for both up and down, then M modeled for 20 consecutive trials with the two members of the pair randomly presented, all slots open, and the disc randomly rotated. The S was then returned to the apparatus for a maximum of 450 trials on the randomly presented pairs with rotation, correction, and closing of slots the same as for the single concepts.

Group I Ss, during the modeling for the first concept, received a piece of sugared cereal each time the model made a response. Group II Ss received no primary reinforcement during modeling. All Ss were reinforced for the initial 38 acquisition trials with sugared cereal, then were given five colored tokens and told, "Let's trade," whereupon E took the tokens and gave S a piece of cereal. Thereafter, tokens, to be exchanged for cereal, were used as reinforcement, both in modeling trials for Group I and acquisition for both groups. Ss in Groups I and II were given no praise.

Groups III and IV did not observe a model, but were placed immediately on the apparatus with the procedure the same as the acquisition trials for Groups I and II; i.e., the face was systematically rotated, or stimuli position changed, and slots opened for 38 trials, and primary reinforcement given. Acquisition continued the same as for Groups I and II to criterion.

Group IV (control) Ss were given no positive verbal reinforcement. However, Group III (experimental) was praised for correct responses: "Atta boy!" "Good boy!"

"That's great!" Use of the phrase "That's right" was avoided because of confusion when learning right-left.

Some Ss, specifically, those in the no-model groups, had to be guided in their first two or three responses. E placed Ss hand on the handle and guided it. Some boys made partial responses, that is, moved the rod part way into the appropriate slot. In this case, E guided it as far as it would go saying, "Go all the way."

Most Ss made anticipatory responses after reinforcement at the beginning of training, starting to move the rod before E gave a command. Each time this occurred, E said, "Don't move the rod until I tell you to do something." Perseverative errors were so common that a "stop, look, and listen" series of commands had to be given frequently, even on every trial with some Ss.

Ss worked on the apparatus for periods varying from five minutes to an hour during the first six weeks of training. All Ss were removed at the first sign of fatigue, boredom, or aggressive or destructive behavior. Behavior of the Ss was extremely variable. All retained their interest for at least an hour on some days. On others, some became hyperactive in the experimental room and were returned to the ward immediately. Others failed to attend and were returned. Some, even though hyperactive and difficult to manage on the ward, were cooperative in the experimental situation. At the end of six weeks, the training period was limited to 30 minutes for the convenience of the experimenter and to insure that each S was exposed to the experimental procedure at least once a day.

Experimenters. Es were the writer and six students, three male and three female. Two were graduate students in psychology, two juniors majoring in special education, and two freshmen with major interests in social work. The students were familiar with the experimental procedure but unfamiliar with the purposes of the experiment. All Es worked with Ss from all groups. Their contacts were systematically randomized. Daily supervision was provided by the writer. As far as could be determined, there appeared to be no significant differences between experimenters in their handling of Ss, or in the response of Ss to them except in the case of one boy who was so aggressive with females that only male Es worked with him. A running log was kept in which each experimenter recorded the Ss he had run, the point at which each S had stopped, and any behavior that was at all unusual, even if such behavior was normal for S on the ward.

RESULTS

For purposes of analysis, each component of the double concepts was grouped with the single concepts, thus Ss were trained on six single and two double concepts with the exception of three Ss in Groups I and IV and two in Groups II and III who were trained on five single and one double concept. The mean score for each S was treated as the raw score in the analyses. Table 3 presents mean trials to criterion for each concept across groups (T = total Ss trained on each concept in each group L = total learners of each concept). Figure 2 presents mean trials to learn single and double concepts for each group.

Two analyses of variance were done and the results are presented in Tables 4 and 5. In the first analysis (Table 4), the data for the groups that observed a model (Groups I and II) were combined and compared with those that did not observe a model (Groups III and IV) to test the first hypothesis, that Ss who observe a model learning a concept will learn in fewer trials than those who do not observe a model. The results indicate that there was no significant difference between groups in the number of trials to learn. However, a trend ($df = 1, 76$; $p<.10$) was suggested in the predicted direction, i.e., the results

TABLE 3.--Mean Trials to Criterion or Cut-off for Each Concept*

Group	I			II			III		
Concept	T	L	$\overline{X}$	T	L	$\overline{X}$	T	L	$\overline{X}$
Up	4	4	48.00	5	5	48.60	4	4	81.25
Down	4	4	48.00	5	5	48.00	4	4	59.75
Up/Down	4	4	100.25	5	5	34.00	4	4	143.25
Long	5	5	138.80	1	1	79.00	1	1	48.00
Short	5	4	170.60	1	1	106.00	1	1	80.00
Long/Short	4	3	171.25	1	0	451.00	1	1	37.00
Right	6	6	50.83	8	8	49.88	9	9	51.56
Left	6	6	54.53	8	8	61.25	9	9	49.67
Right/Left	6	5	207.17	7	7	45.86	9	6	191.11
Push	3	3	49.67	5	5	49.00	5	5	48.20
Pull	3	3	48.00	5	5	49.40	5	5	48.00
Push/Pull	3	2	199.00	5	4	143.80	4	1	411.25
Between	7	5	217.57	2	2	60.00	3	2	272.67
Over	6	4	243.17	9	9	182.66	8	4	286.38
Under	4	4	152.75	0	0	--	0	0	--
Beside	4	2	306.25	9	7	204.11	8	6	186.88
Total	74	65		76	72		75	62	
$\overline{X}$			137.85			107.50			129.41

TABLE 3.--Continued.

Group	IV			Total, All Groups		
Concept	T	L	$\overline{X}$	T	L	$\overline{X}$
Up	3	3	48.00	16	16	56.46
Down	3	3	48.00	16	16	50.94
Up/Down	3	3	36.67	16	16	78.54
Long	5	4	150.40	12	11	104.05
Short	5	5	156.80	12	12	128.35
Long/Short	4	4	172.75	10	8	208.00
Right	6	6	50.50	29	29	50.69
Left	6	6	54.00	29	29	54.81
Right/Left	6	3	299.83	28	21	185.99
Push	4	4	109.50	17	17	64.09
Pull	4	4	60.50	17	17	51.48
Push/Pull	3	3	138.67	16	11	223.18
Between	6	4	241.67	18	13	197.98
Over	5	3	294.20	28	20	251.60
Under	4	3	248.25	8	7	200.50
Beside	4	3	427.50	25	18	281.19
Total	71	62		297	260	
$\overline{X}$			169.37			

*T: Total Ss trained on concept
L: Learners of concept

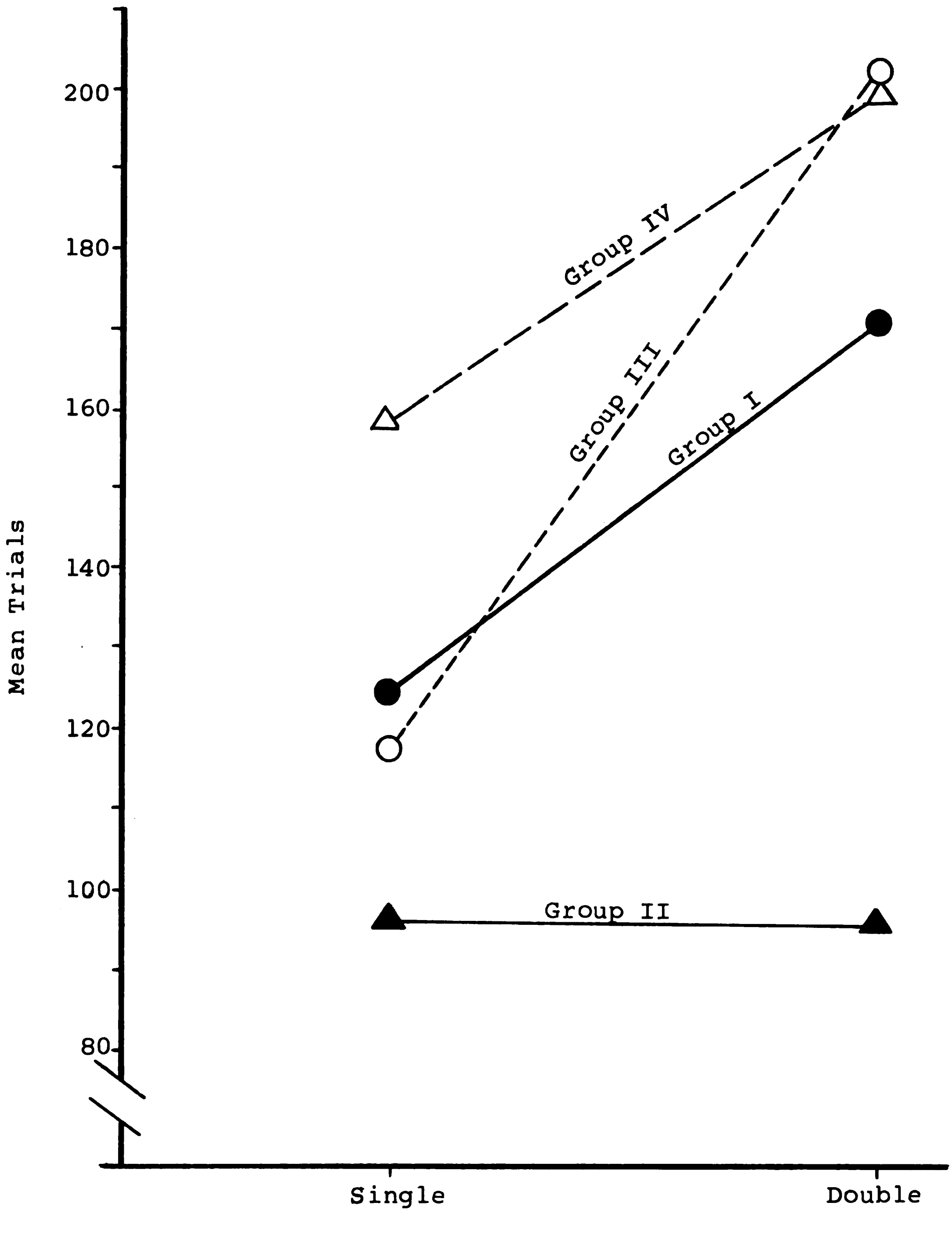

Figure 2. Mean number of trials to learn single and double concepts.

TABLE 4.--Analysis of Variance: Concept Condition (Double or Single) X Modeling Condition (Model or No-model)

Source	df	MS	F
Concepts (A)	1	31,920	2.31
Treatments (B)	1	40,052	2.90*
A X B	1	10,035	.73
error	76	13,811	

*p<.10

TABLE 5.--Analysis of Variance: Treatment Groups X Concept Condition (Double or Single)

Source	df	MS	F
Between Ss	39		
Treatments (A)	3	10,640	.51
error	36	20,551	
Within Ss	40		
Concepts (B)	1	76,118	IQ.31**
A X B	3	6,028	.81
error	36	7,381	

**p<.01

for groups that observed a model showed a nonsignificant tendency to be superior to those for groups that did not.

Intergroup comparisons were done in an attempt to sort out factors which may have been responsible for the nonsignificant results. Table 6 ranks the means of the four groups for both double and single concepts. Two-tailed *t* tests were made on both single and double concept conditions between the means of the following groups: I and IV, II and IV, and I and II. Tests were made between the means of Groups II and III and Groups III and IV on the single concept condition only. Table 7 shows the *t*s for the intergroup comparisons made. Group II (no reinforcement for observing the model) ranked first on both single and double concept acquisition. When this group was compared with Group IV (control), which ranked fourth on single concept acquisition and virtually tied with Group III (praise) for last position on double concept acquisition, *t* was significant under both concept conditions ($df = 18$; $p<.05$). However, when Group I (reinforced for observing) was compared with Group IV, *t* was not significant ($df = 18$; $p<.25$) under either condition.

Inspection of the means makes it obvious that the data do not support the second hypothesis, that reinforcement for observing a model leads to faster learning, since the means were in the opposite direction to that predicted. The second analysis tested for differences between

TABLE 6.--Ranked Means of Groups for Single and Double Concept Conditions

Single	Double
97 (Group II)	96 (Group II)
118 (Group III)	171 (Group I)
135 (Group I)	200 (Group IV)
159 (Group IV)	202 (Group III)

TABLE 7.--*t* Values for Intergroup Comparisons of Trials to Criterion for Single and Double Concepts

Group Comparisons	*t* Values Single	*t* Values Double
I and IV	.68	.41
II and IV	1.98**	1.88**
I and II	1.34*	1.30
II and III	.84	
III and IV	1.22	

*p<.10

**<p .05

treatment groups regardless of direction as well as concept conditions (double or single). The *F* for treatments was not significant (*df* = 1,36; $p > .25$). However, *F* for concepts was significant (*df* = 1,36; $p < .01$), suggesting that double concepts were more difficult to learn than single.

When means for Groups I and II were compared on the single concept condition, *t* approached significance (*df* = 19; $p < .10$), suggesting a trend. When means for these groups were compared on the double concept condition, the *t* again suggested a trend (*df* = 18; $p \simeq .10$).

The third hypothesis of no difference between Group III (praise) and Group IV (control) cannot be rejected on the basis of a nonsignificant *F* (*df* = 3,36; $p > .25$).

An additional *t* test combining all *S*s from all groups was made. A comparison was made between pre- and posttest scores on the concept knowledge test. This involved only those concepts on which each *S* was trained. The average difference between pre- and posttest scores was significant (*df* = 39; $p < .001$). All "non-learners," here defined as those *S*s who did not reach criterion on MUDRAFA on one or more concepts (N = 17), were extracted. A *t* test was made between their pre- and posttest scores. The average difference was significant (*df* = 16; $p < .001$). This suggests that even those *S*s who failed to reach criterion in training nonetheless demonstrated their having acquired understanding of the concepts on which they received training since posttest scores were significantly superior to pretest scores on those concepts on which they were trained.

Four to six weeks following training all available Ss (N = 31) were tested for retention on the concept test. Nine Ss were unavailable because of illness, transfer to another institution, or because they were at home on visits. A t test was made between pretest and retention test scores. The mean difference was significant (df = 30; $p < .001$). There was no difference between posttest and retention scores. Tables 1 through 4 in Appendix C list pretest, posttest, and retention test scores for each S from each group.

DISCUSSION

The first hypothesis predicting superiority of the modeling condition was not supported, although a trend was suggested (*df* = 1,76; $p<.10$). An examination of the post hoc analyses might suggest reasons for this. Even though both Groups I and II observed a model, the difference between the groups on both concept conditions approached significance (*df* = 18; $p \approx .10$). However, Group I (reinforced for observing) did not differ (*df* = 18; $p>.25$) from Group IV (control) on either condition while Group II (not reinforced for observing) differed significantly from Group IV on both double and single concept conditions (*df* = 18; $p<.05$). Thus when Groups I and II were combined for comparison with the combined no-model groups, the burden of evidence in support of modeling rested entirely on Group II.

It appears that the reinforcement given Group I reduced any effect modeling might have. One explanation might be that an extraneous behavior might have been reinforced, such as watching for the light or listening for the buzzer or even turning to *E* in response to the light and buzzer. This behavior by the *S*, usually paired with holding out his hand, was observed after a few modeling trials but at the time was considered an anticipatory goal response. Another explanation might be that the reinforcement served to interfere with observing by acting as a distractor. To determine if the latter is true, a future study might replicate training conditions of the two model groups but introduce to one group a distractor such as periodic noise in place of reinforcement during modeling.

The second hypothesis was not supported. If retardates do have an attention deficit, rewarding the severely retarded for what appeared to be attending, i.e., observing the model, does not appear to reduce this deficit, but in the present case appeared to enhance it when the two model groups are compared. The means for both single and double concept conditions for the group that was reinforced for observing a model showed a non-significant tendency to be inferior to the group that was not reinforced for observing a model. One must consider, however, the difference between learning to observe a model and learning to attend to relevant cues. _S_s in Group I may have been responding to the entire stimulus complex of machine, model, and reinforcement, or to one or more aspects of this complex rather than to the hypothesis-relevant cues. These cues were: (1) the spoken command which directed the _S_'s attention to the apparatus, "Watch," then the statement of what _M_ was about to do, e.g., "Go _up_;" and (2) the appropriate motor response of _M_ on the apparatus in relation to the verbal cue (up). This was repeated over a series of trials after which the S was required to make the appropriate motor response himself following the same cue words.

The stimulus complex was identical for both groups except that Group II was not reinforced, as defined in this study, for observing. It appears that the absence of reinforcement during modeling was the variable which was responsible for Group II's superiority. Perhaps retardates at this level can focus on relevant cues as long as they are few and simple, but when his limit for processing these cues in the experimental context is reached, the addition of even one element may break the experimental set.

The apparatus itself appeared to have a fascination for the Ss. Initially, it was novel and it would seem to have retained some of its novelty throughout the experiment. When E entered a ward, Ss would frequently clamor to be the first one to go. Frequently Ss did not want to stop the training sessions, and a few had to be carried bodily from the experimental room. The rewarding properties of MUDRAFA have been noted by Denny (1966) and Yascolt (1966). Armitage[1] found that manipulating the prototype of MUDRAFA was satisfying to schizophrenics. Perhaps primary reinforcements dilute the reinforcing properties of the apparatus when the S can only watch and not manipulate.

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[1]S. G. Armitage, personal communication, June 20, 1968.

Although the third hypothesis of no difference between Group III (praise) and Group IV (control) could not be rejected, when individual comparisons are examined, this result becomes questionable. The differences between the means of trials to learn single concepts and trials to learn double concepts (Table 6) for all groups except Group II suggests that single concepts are easier to learn than double. Group III ranked second on single concept acquisition and did not differ from Groups I or II. However, the difference between Groups III and IV approaches significance (*df* = 18; $p < .10$). This suggests that praise is as powerful as modeling when training involves easy concepts, but this equality disappears when severely retarded *S*s are trained on difficult concepts. This relationship can be seen in Figure 2. Perhaps praise combined with modeling would be a more powerful elicitor than either reinforcement alone under all conditions of concept difficulty. Considering these data, this study does little to support any generalized position concerning the effectiveness of praise as a reinforcer. It does suggest, as do some previous studies, that praise interacts differentially with other factors, as yet unidentified in the severely retarded.

The evidence for single concepts being easier and double concepts being more difficult to learn becomes equivocal when the data are scrutinized closely (Table 3).

The double concepts do appear to be harder to learn than their single components, but no harder, and indeed perhaps even easier, than more abstract single concepts such as between and beside. Future research might use the more simple concepts, either single or double, for pretraining and the more difficult ones to test hypotheses.

There was no evidence for the optimistic view expressed earlier that severely retarded Ss might, by means of modeling, be trained in groups. Even if the results had clearly demonstrated that modeling is superior to no modeling, the behavior of the Ss during the study indicates that group learning on MUDRAFA is not feasible, at least in the early stages of training. Constant vigilance on the part of the E had to be maintained to keep the S at the tasks of watching the model and responding to commands. Some Ss sat quietly throughout most training sessions, but most exhibited exploratory behavior directed toward the machine, other objects in the room, and even the E. Group training might be possible with some Ss after a period of individual training, using a live model, film, or closed circuit television.

Denny (1966) feels that retardates learn faster if errors are prevented or minimized and for this reason the present study as well as Yascolt's (1966) was designed to minimize errors. This assumption has not been tested experimentally on MUDRAFA. A procedure which did not attempt to prevent errors in one group might not only clarify this issue but would also allow for an analysis of patterns of errors, impossible in the present study. The model in this study made no errors but the advisability of this is brought into question by the results of Herbert and Harsh (1944) who found that cats learned faster if they observed another learn, and even more rapidly if they began their observations early in the model cat's learning when more incorrect manipulations were made. Perhaps modeling would be more effective if errors were programmed into the model's "learning."

Denny's (1966) and Yascolt's (1966) studies suggested that MUDRAFA is an effective instrument for training the severely retarded. The present study supports their results. Part of MUDRAFA's effectiveness might be explained if manipulation is reinforcing as others have found (Armitage, see footnote 1; Doty, et al., 1967). In the present study, the scores on the concept knowledge test improved between pre- and posttest except for two Ss, one in Group II where scores were the same, and one in Group IV where the posttest score was lower than the pretest. In the latter case, the retention score was higher than the pretest score. Of those Ss who were tested for retention, only two had retention scores equal to pretest scores, both in Group III. One S, in Group IV, earned a retention score lower than his pretest score. All other

Ss showed improvement and the difference was significant between pre- and posttest, with no difference between posttest and retention test.

This study has demonstrated that MUDRAFA has (1) potential for training the severely retarded; and (2) pronounced research capabilities. In the former case individualized training procedures might well maximize learning directed toward rehabilitative goals. In the latter, the demonstration that standardized reinforcement programs do result in learning minimizes problems of experimental procedures and analysis.

SUMMARY

Four groups of 10 severely retarded male Ss were trained on prepositional concepts by means of the Multiple Differential Response And Feedback Apparatus (MUDRAFA). Group I observed a model "learn" a concept and was given primary reinforcement (sugared cereal) each time the model made a correct response. Group II observed the model, but was given no primary reinforcement.

Both model groups were allowed to manipulate the apparatus following each block of eight modeling trials. There was a total of 38 modeling trials after which the S was placed at the machine until the criterion for acquisition, 10 consecutive correct responses, or a maximum of 450 trials was reached. This procedure was followed for each concept.

Group III observed no model, but received positive verbal reinforcement for each correct response.

Group IV (control) neither observed a model nor was praised for correct responses. The training procedure for this group was the same as that described below for procedure basic to all groups.

All four groups were given cereal for each correct response during the initial 38 acquisition trials. Beginning with trial 39 of acquisition of the first concept, Ss

were given tokens which were exchanged for cereal (FR 5:1). Correct responses for all four groups were signaled by a light and buzzer in addition to the cereal and tokens. Errors were signaled by absence of the light and buzzer and E's saying, "No, that's wrong." The correction method was used when errors were made, and errors were minimized by closing off incorrect slots on the apparatus after two consecutive errors were made.

Three hypotheses were tested. The first was: Severely retarded Ss who observe a model "learn" a concept learn the same concept in fewer trials than those who observe no model. This hypothesis was not supported. However, there was a nonsignificant trend in the predicted direction. Post hoc analyses indicated Group I was not significantly different from Group IV (control) in trials to learn, while Group II (not reinforced for observing) was significantly superior to Group IV. Differences between Groups I and II approached significance, thus, when the two model groups were combined for comparison with the combined no-model groups, any superiority that modeling might have had was clouded by the inferiority of Group I.

The second hypothesis was: Ss who are reinforced for observing a model learn in fewer trials than those who are not reinforced for observing. This was not supported. Indeed, the results were in the opposite direction, and the difference between the two groups approached significance. This suggested that reinforcing a S for observing a model interferes with attending to relevant cues in the modeling situation.

The third hypothesis was: Ss who receive primary verbal reinforcement (praise) in addition to primary, secondary, and negative verbal reinforcement do not differ in trials to learn concepts on MUDRAFA from those who are not given positive verbal reinforcement. The null hypothesis could not be rejected. However, post hoc analyses indicate that Group III (praise) did not differ from the two model groups on those concepts which appeared to be easier to learn, but were inferior to the model groups on the apparently more difficult concepts. It was suggested that praise combined with modeling might be additive.

All Ss were tested for their knowledge of the experimental concepts prior to training and after training in a real-life situation. They were also tested for retention four to six weeks after the conclusion of training. Scores of all Ss were combined. Significant differences were found between pretest and posttest scores and between pretest and retention test scores. Posttest and retention test scores did not differ. The results suggest that Ss from all groups learned.

It was concluded that MUDRAFA has (1) potential for training the severely retarded, and (2) pronounced research capabilities.

REFERENCES

Bandura, A. & Walters, R. R. *Social learning and personality development*. New York: Holt, Rinehart, & Winston, 1964.

Benoit, E. P. Relevance of Hebb's theory of the organization of behavior to educational research on the mentally retarded. *American Journal of Mental Deficiency*, 1957, *61*, 497-506.

Curry, C. Supplementary report: The effect of verbal reinforcement combinations on learning in children. *Journal of Experimental Psychology*, 1960, *59*, 434.

Denny, M. R. Research in learning and performance. In H. A. Stevens & R. Heber (Eds.), *Mental retardation: A review of reserach*. Chicago: University of Chicago Press, 1964.

Denny, M. R. A theoretical analysis and its application to training the mentally retarded. In N. Ellis (Ed.), *International review of research on mental retardation*. Vol. 2, 1966.

Doty, B. A., Neuman, M. C., & Prucha, C. Relative effectiveness of verbal, manipulative, and visual rewards on children's learning. *Psychological Record*, 1967, *17* (1), 29-34.

Ellis, N. R., & Distefano, M. K., Jr. Effects of verbal urging and praise upon rotary pursuit performance in mental defectives. *American Journal of Mental Deficiency*, 1959, *64* (3), 486-490.

Ellis, N. R., & Pryer, M. W. Primary versus secondary reinforcement in simple discrimination learning of mental defectives. *Psychological Reports*, 1958, *4*, 67-70.

Herbert, J. J., & Harsh, C. M. Observational learning by cats. *Journal of Comparative Psychology*, 1944, *37*, 81-95.

Hurlock, E. B. An evaluation of certain incentives used in school work. Journal of Educational Psychology, 1925, 16, 145-159.

Matsuda, M. & Matsuda, M. The effects of verbal reinforcement combinations on acquisition and extinction of discrimination learning in infants, children and feeble-minded children. Japanese Journal of Educational Psychology, 1966, 14 (2), 65-70. (Psychological Abstracts, 1966, 40 (11), No. 12140.

Meyer, W. & Seidman, S. B. Age difference in the effectiveness of different reinforcement combinations on the acquisition and extinction of a single concept learning problem. Child Development, 1960, 31, 419-429.

Miller, N. E. & Dollard, J. Social learning and imitation. New Haven: Yale University Press, 1941.

Newman, L. M. The effects of reinforcement variation on concept formation in retarded boys. (Doctoral dissertation, Western Reserve University) Ann Arbor, Mich.: University Microfilms, 1966. No. 66-5204.

Risley, T. & Wolf, M. M. Experimental manipulation of autistic behavior and generalization into the home. In R. Ulrich, T. Stachnik, J. P. Mabry, (Eds.), Control of human behavior, Glenview, Ill.: Scott-Foresman and Co., 1966.

Rosenblith, J. F. Learning by imitation in kindergarten children. Child Development, 1959, 30, 69-80.

Stevenson, H. W. & Snyder, C. Performance as a function of the interaction of incentive conditions. Journal of Personality, 1960, 28, 1-11.

Sullivan, P. W. The effects of verbal reward and verbal punishment on concept elicitation in children. (Doctoral dissertation, Wayne State University) Ann Arbor, Mich.: University Microfilms, 1964. No. 64-3325.

Terrell, G., Jr. & Kennedy, W. A. Discrimination learning and transposition in children as a function of the nature of the reward. Journal of Experimental Psychology, 1957, 53 (4), 257-260.

Willicutt, H. C. & Kennedy, W. A. Relation of intelligence to effectiveness of praise and reproof as reinforcers for fourth graders. Perceptual and Motor Skills, 1963, 17 (3), 695-697.

Wilson, W. C. Imitation and the learning of incidental cues by preschool children. Child Development, 1958, 29, 393-398.

Wolfensberger, W. Differential rewards as motivating factors in mental deficiency research. American Journal of Mental Deficiency, 1960, 64 (5), 902-906.

Yascolt, M. A. Analysis of a method of training the mentally retarded. Unpublished master's thesis, Michigan State University, 1966.

Zeaman, D. & House, B. J. The role of attention in retardate discrimination learning. In Ellis, M. R. (Ed.), Handbook of mental deficiency: Psychological theory and research. New York: McGraw-Hill, 1963.

Zigler, E. & deLabry, J. Concept-switching in middle-class, lower-class, and retarded children. Journal of Abnormal and Social Psychology, 1962, 65 (4), 267-273.

Zigler, E. F., Hodgden, L., & Stevenson, H. W. The effect of support on the performance of normal and feeble-minded children. Journal of Personality, 1958, 26, 106-122.

APPENDICES

APPENDIX A

CONCEPT KNOWLEDGE TEST

Group:_______ Pretest date:_______
Posttest " :_______
Retention " :_______

Name:_________________________ Birthdate:_______________

CA:________ MA:_______ IQ:_______ Date tested:_________

Behaviors Imitated:________

Concepts Known

Pretest:_____ Posttest:_____ Retention test:_____

Imitation Test

___ 1. "Do this" (raise hand)
___ 2. " (stamp foot)
___ 3. " (clap hands)
___ 4. " (slap thigh)
___ 5. " (stand up)
___ 6. " (sit down)

Concepts

Pre	Post	Ret	
			1. Push/Pull
___	___	___	a. Push my hand
___	___	___	b. Pull my hand
___	___	___	c. Push the car
___	___	___	d. Pull the truck
			2. Up/Down
___	___	___	a. Point up
___	___	___	b. Point down
___	___	___	c. Look up
___	___	___	d. Put this (toy) down

Pre	Post	Ret	
			3. Long/Short
___	___	___	a. Point to the short one (paper strip)
___	___	___	b. Point to the long one (pipe cleaner)
___	___	___	c. Give me the short pencil
___	___	___	d. Give me the long block
			4. Right/Left
___	___	___	a. Raise your right hand
___	___	___	b. Raise your left foot
___	___	___	c. Pick up the car on the right
___	___	___	d. Give me the block on the left
			5. Over
___	___	___	a. Put your hand over my hand
___	___	___	b. Hold the car over the table
___	___	___	c. Put your hand over your head
___	___	___	d. Put the hanky over the car
			6. Between
___	___	___	a. Put your hand between my hands
___	___	___	b. Make the car go between the blocks
___	___	___	c. Walk between the wall and the table
___	___	___	d. Walk between me and the table
			7. Under
___	___	___	a. Put your hand under my hand
___	___	___	b. Put your hand under the table
___	___	___	c. Put the car under the chair
___	___	___	d. Put the ball under the box
			8. Beside
___	___	___	a. Put the car beside the block
___	___	___	b. Stand beside me
___	___	___	c. Put the car beside the box
___	___	___	d. Put your hand beside the cup

APPENDIX B

TABLE 1.--Chronological Age, Mental Age, IQ Means, and Concepts Known Before Training for All Groups

Group	$\overline{CA}$	$\overline{MA}$	$\overline{IQ}$	Concepts Known
I	19-03	28.5 mo	15.5	2.2
II	18-10	25.2 mo	10.5	1.4
III	18-09	24.8 mo	12.4	1.2
IV	17-05	26.9 mo	13.5	1.2

TABLE 2.--Chronological Age, Mental Age, IQ, and Concepts Known Before Training: Experimental Group I (Reinforced During Modeling)

Subject	CA (years-months)	MA (months)	IQ	Concepts
A	13-11	36	35	4
B	18-00	25	10	1
C	15-04	26	10	0
D	30-11	59	40	4
E	21-00	26	10	2
F	15-11	22	10	2
G	20-04	22	10	3
H	21-07	23	10	4
I	16-11	27	10	2
J	18-08	19	10	0

TABLE 3.--Chronological Age, Mental Age, IQ, and Concepts Known Before Training: Experimental Group II (Not Reinforced During Modeling)

Subject	CA (years-months)	MA (months)	IQ	Concepts
A	11-08	27	10	1
B	14-10	19	10	1
C	16-10	25	10	1
D	31-10	26	10	4
E	14-09	28	10	1
F	23-06	26	10	0
G	25-09	21	10	2
H	15-01	33	15	3
I	14-03	28	10	0
J	19-05	19	10	1

TABLE 4.--Chronological Age, Mental Age, IQ, and Concepts Known Before Training: Experimental Group III (Positive Verbal Reinforcement)

Subject	CA (years-months)	MA (months)	IQ	Concepts
A	13-11	22	10	2
B	17-05	28	10	2
C	16-01	18	10	0
D	12-09	23	10	1
E	20-03	23	10	0
F	21-10	49	34	4
G	21-07	19	10	1
H	20-06	17	10	1
I	15-04	21	10	1
J	27-11	28	10	0

TABLE 5.--Chronological Age, Mental Age, IQ, and Concepts Known Before Training: Group IV (Control)

Subject	CA (years-months)	MA (months)	IQ	Concepts
A	18-02	27	10	1
B	15-10	18	10	1
C	12-01	23	10	3
D	14-11	22	10	3
E	17-03	19	10	2
F	16-11	32	14	1
G	17-07	18	10	0
H	13-08	36	20	1
I	24-09	41	26	0
J	23-01	33	15	2

APPENDIX C

TABLE 1. Concept Knowledge Pre-, Post-, and Retention Test Scores: Group I

Subject		Pretest	Posttest	Retention
A		4	15	14
B		5	13	11
C		7	13	13
D		6	14	14
E		5	13	14
F		7	10	9
G		4	9	8
H		8	16	17
I		5	17	
J		3	13	10
	Σ	54	133	110
	$\bar{X}$	5.40	13.30	12.22

TABLE 2.--Concept Knowledge Pre-, Post-, and Retention Test Scores: Group II

Subject		Pretest	Posttest	Retention
A		6	13	12
B		6	10	8
C		4	9	11
D		6	8	
E		1	15	15
F		5	17	11
G		6	10	
H		6	16	14
I		8	14	10
J		2	2	
	Σ	50	114	81
	$\bar{X}$	5.00	11.40	11.57

TABLE 3.--Concept Knowledge Pre-, Post-, and Retention Test Scores: Group III

Subject		Pretest	Posttest	Retention
A		7	14	12
B		8	13	
C		6	11	12
D		7	14	11
E		6	13	11
F		6	17	16
G		5	14	
H		5	9	
I		7	12	7
J		3	6	3
	Σ	60	123	72
	$\bar{X}$	6.00	12.30	9.00

TABLE 4.--Concept Knowledge Pre-, Post-, and Retention Test Scores: Group IV

Subject		Pretest	Posttest	Retention
A		7	17	16
B		5	4	8
C		8	15	16
D		4	7	10
E		3	8	
F		7	17	16
G		5	8	3
H		5	11	11
I		5	16	11
J		6	10	
	Σ	55	113	91
	$\bar{X}$	5.50	11.30	11.37