THE EFFECT OF LEARNING SET ACQUISITION ON THE IQS OF DISADVANTAGED PRESCHOOL CHILDREN

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By

Helen L. Carreker, B. A.
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THE EFFECT OF LEARNING SET ACQUISITION ON THE IQS OF DISADVANTAGED PRESCHOOL CHILDREN

General learning ability is a combination of many relatively independent abilities, some of which have not yet been identified and studied experimentally. The acquisition of learning sets, a learning ability which has received considerable attention in the literature, involves the ability to solve single problems, generalize their solutions, transfer such information from one problem to another, and form concepts.

Learning set is the acquired ability to solve a particular kind of problem. Discrimination learning set problems have different stimuli but a common basis for solution. The identification by the _S_ of the characteristic which these problems have in common is the discrimination learning set. Harlow (1949) wrote that learning set acquisition depends upon a higher level of thought than is required for single problem learning. The particular set learned determines in large part which stimuli will be generalized in future problem solving.

For discrimination learning set acquisition to occur, the _S_ must formulate a strategy or hypothesis from information available to him. At the same time he must inhibit all competing problem-solving strategies. Learning set acquisition is accompanied by a progressively greater percentage of correct responses as successive problems are presented. Improvement over successive problems is attributed to the S's learning to discriminate between stimulus objects and to change his stimulus preference when a particular choice is not reinforced. Later discriminations are learned more quickly and with considerably less effort than problems presented early in training.

Discrimination per se is concerned with the perceptual ability of an organism and must be differentiated from the discrimination learning set. Discrimination learning situations require a S to respond differentially to stimuli presented either simultaneously or successively. The S responds differentially when he chooses one stimulus but not the other or when he makes a different response to each stimulus. Learning set training, the presentation of a series of similar problems, encourages the S to pay attention to cues which he may not have noticed as he learned the first few discriminations.

A S cannot solve problems insightfully, or with maximal efficiency, without a history of earlier solutions to similar problems. Harlow (1949) hypothesized that all concepts involving shape, size, number, color, and position evolve from learning set acquisition. This generalization that concept formation is dependent on a learning set mechanism appears to hold for all mammalian species that have been studied.

Discrimination learning set has been studied in humans, with considerable attention given to the effects of age and intelligence on learning set acquisition (Barnett & Cantor 1957; Ellis, Girardeau, & Pryor 1962; Harter 1965, 1967; House and Zeamon 1958; Jenson 1963; Katz 1967; Koch & Meyer 1959; Levinson & Reese 1967; Reese 1963; Stevenson & Swartz 1958; Wischner & O'Donnell 1962). These studies indicate that typically older children and those with a high level of measured intelligence acquire discrimination learning sets most rapidly.

The number of problems required to form a learning set is influenced by both IQ and mental age (MA), with the effect of IQ seemingly enhanced when a complex problem and a wide range of IQs are studied. IQ determines how much a child can learn at any given age level; it is a measure of capacity. Mental age is a developmental measure of cognitive ability which expresses the amount of prior learning.

Harter (1965) developed a three-level factorial design to assess the relative contributions of IQ and MA measures as well as their interaction in the process of learning set acquisition. She concluded that although both IQ and MA contribute independently to the learning process, a combination of IQ and MA can best predict learning set acquisition. Harter summarized her findings by stating that the higher the level of both IQ and MA, the more rapid will be learning set formation. It is her opinion that researchers have previously focused too much attention on the isolated MA concept.

In another study of IQ, MA and motivational factors in learning set performance, Harter's design included three levels of IQ, retarded, normal, and high; and two MA levels. She found that the higher MA Ss reached criterion in fewer problems than did the lower MA Ss. During the pre-criterion period, Ss at the higher MA level tended to employ hypotheses that appeared more similar in nature to the problem solution than did Ss with lower MA scores. Harter's findings suggested further that higher IQ Ss were able to eliminate the same erroneous hypotheses more quickly than lower IQ Ss with comparable MAs.

Hayes, Thompson, and Hayes (1953) hypothesized that learning set in a visual-object discrimination problem is a function of the number of problems learned. They found that Ss with higher MA scores reached a criterion of five successive correct choices after fewer problems; while Ss with initially higher IQ scores eliminated erroneous problem-solving strategies more quickly. Harter (1965) found that once a learning set is acquired, training on additional problems produces little further improvement in performance. She also noted an accelerated rate of learning for all her Ss as they approached criterion.

The relation between learning set acquisition and chronological age (CA) was found to be neglibible in Harter's studies (1965, 1967). Although CA has often been used to predict learning set performance in normal children, Harter qualifies this relationship. She suggests that CA will predict learning set acquisition only to the extent that it is positively correlated with MA and not negatively correlated with IQ. Harter's near zero correlation between CA and learning set acquisition is critical, since her finding that IQ and MA independently contribute to learning set acquisition is based upon this assumption that CA does not directly affect this relationship. Levinson and Reese (1963) also found no significant relation between CA and rate of learning set acquisition for children between the ages of three and five years.

With instructions to verbally name the stimuli in a problem, a S's learning rate often increases dramatically. It has therefore been hypothesized that preverbal children should acquire learning sets more slowly than older (verbal) children, because they lack this ability to verbalize in their problem solving. Another reason may be an inappropriate or undifferentiated use of verbal labels, such as "colored" for both "red" and "blue."

Learning Set Acquisition in Disadvantaged Preschool Children

In their study of learning set acquisition in children from disadvantaged backgrounds, Jacobson, Berger, Bergman, Millham, and Greeson (1971) looked at the effects of the acquisition of learning sets and social interaction on the intellectual development of preschool aged children from non-middle class homes.

Jacobson et al. hypothesized prior to this study that their concept development program (CDP), which involved the children in the acquisition of learning sets, would produce significant gains in measured IQ. They further hypothesized that older Ss would acquire learning sets more quickly than younger Ss, and that the modeling and feedback techniques would result in faster learning set acquisition than simple reinforcement for correct responding. Jacobson et al. assumed that these two conditions would result in more effective learning because additional information was provided by the modeling of correct responses immediately before (modeling technique) or after (feedback technique) the Ss were asked to respond to the stimulus problems. There was also more interaction with an approving E for Ss in both of these conditions.

The Ss were twenty-six boys and twenty girls who attended the daycare center for families earning below the federally defined poverty level income of $3000 annually per family of four. The sample included thirty-three Blacks, five children of Spanish origin, and three native American Whites. The mean age of Ss in the experimental conditions was forty-four months and of Ss in the control group, fifty-four months.

Ten of the children were assigned to the control condition, wherein each S was given the Stanford-Binet Form L-M (SB-LM) twice, with no intervening learning experiences provided. The remaining thirty-six

Ss were randomly assigned to the three experimental conditions, and these children learned the CDP devised by Jacobson et al. The CDP consists of thirty-nine concept problems and employs a two-choice discrimination learning procedure. Twenty learning trials (exposures to the correct concept) were given for each problem and were repeated until a criterion of ten consecutive responses in either the first or second 10-trial block of concept instances, or eight or more correct responses for both consecutive blocks of ten instances was reached.

Stimuli presented in the two-choice problems were varied randomly on attributes of the following five dimensions:

(a) shape - circle, square, triangle
(b) size - large, small
(c) quantity - one, two
(d) color - red, blue, green, yellow
(e) position - right, left

A different set of stimuli was used for each problem. The single and multiple dimension problems differed in complexity, but required a common strategy for solution. The single dimension stimuli differed along a single dimension (e.g. color), and the multiple dimension stimuli varied simultaneously along two, three, or four dimensions (e.g. color and size; color, size, and shape; color, size, shape, and quantity).

During an adaptation period each S learned to point to three consecutive instances of the concept to be learned. This procedure was used by the authors to demonstrate to nonverbal Ss the concept to be learned. During the baseline procedure following adaptation, Ss were asked to point to the ten successive instances of the demonstrated concept,(e.g. red, blue-circle, small-green-triangle, etc.).

Twenty-five percent of the S's responses were verbally reinforced during the baseline period, but reinforcement was not made contingent on correct responding. Rather, the S was told that he was being praised for "playing the game." If criterion was reached during the baseline period, the S began adaptation on the next problem; if not he started the acquisition period and continued responding to the same concept problem until he reached criterion.

Twelve Ss were randomly assigned to each of the three experimental conditions: reinforcement, modeling, and feedback. In the reinforcement condition the experimental procedure consisted of rewarding each correct response with praise and a piece of frosted cereal. When an incorrect response was made the S was told that he was incorrect and no reinforcement was given. In the modeling condition one E modeled ten correct responses for the S prior to the presentation of each series of twenty acquisition trials. To maintain his attention, the cereal reward was given twenty-five percent of the time that S viewed the model being rewarded by the other E. In the feedback condition, one of the Es was designated as the S's partner. The S made the initial response and if correct, both he and the E partner were rewarded. Following his response, the S would watch his E partner respond correctly to the same problem and both were again reinforced. If the S's initial response was not correct, neither he nor his partner received reward. The S then watched his partner, one of the Es, respond correctly. The correct response of the partner was followed by reward to both the partner E and the child.

Results of this experimental study showed a rapid decrease in the number of 10-trial blocks necessary for Ss to reach criterion on the first fifteen concept problems. Thus, the more complex problems learned later in the CDP were solved more quickly than the less complex problems learned earlier in the program.

For the ten Ss in the no-treatment control condition, the mean IQ on the first administration of the SB-LM was 84.70. The mean IQ for the second testing was 85.60, a non-significant increase of 0.9 IQ points.

As a result of their participation in the CDP, Ss in all three treatment conditions showed substantial increases in intelligence test scores. A mean increase of 21.08 IQ points was obtained in the modeling condition, while Ss in the reinforcement condition increased 10.58 points in IQ and Ss in the feedback condition increased 8.16 points. All of these increases were statistically significant, but increments in measured IQ for the Ss in the modeling condition were significantly greater than in the other treatment conditions.

There was also a consistent tendency for Ss with initially low IQs (46-83) to show greater increments in IQ as a result of participation in the CDP than initially higher IQ Ss. This tendency was most pronounced in the modeling condition, where Ss initially low in measured intelligence increased their mean IQ scores by over thirty points. In terms of S performance and speed of acquisition of learning sets, all three treatment conditions were considered highly effective.

A follow-up study by Jacobson and Greeson (1972) demonstrated that these increased IQ scores were retained over a fourteen month period when approximately seventy-five percent of the original sample were retested. This retention of gains in measured IQ was related to the original experimental condition to which Ss were randomly assigned. The greatest decline between post-test IQ and follow-up scores occurred in the modeling condition in which the largest initial gains had been made. A mean decrease of 11.22 IQ points was found for Ss in the modeling condition.

In contrast, Ss in the reinforcement condition demonstrated only a negligible decline of .20 IQ points. The total gain for the reinforcement condition, as indicated by the difference between initial and follow-up scores, is comparable with that found in the modeling condition. In contrast, the follow-up study found that Ss originally assigned to the feedback condition demonstrated a substantial decline of 4.88 IQ points.

The high degree of retention of IQ gains found on the follow-up administration of the SB-LM suggests that the children continued to progress in their intellectual development at a rate similar to that found for middle-class youngsters. It is likely that learning to think effectively has important consequences for the individual's daily life, including an enhancement of motivation for continued progress in similar school-type situations. The data presented by Jacobson et al. support the rationale that placing children with limited prior learning experiences in situations highly conducive to rapid learning results in improved cognitive functioning.

Prior research has established a relationship between IQ and the rate of acquisition of learning sets. Jacobson et al. have demonstrated this to be a cause-effect relationship in that their study showed that the acquisition of a series of learning sets was followed by an increase in measured intelligence. The study reported in the following pages is an attempt to replicate the findings of Jacobson et al., using a considerably shortened and simplified version of the original CDP. Any procedure which appears to produce such dramatic increases in the intellectual development of preschool aged children with limited prior learning experiences should be carefully considered. If, in addition to the learning strategies gained, such a program results in competence in tasks similar to those the children will encounter in school, then training in the acquisition of discrimination learning sets should be implemented as part of readiness programs for preschool children.

The purpose of this replication was to evaluate whether or not the following hypotheses, adapted from Jacobson et al., would be supported.

1. The higher the initial (pre-test) IQ score, the more rapid will be the acquisition of learning sets.

2. Ss in the modeling condition will acquire the learning sets in fewer trials than will the Ss in the reinforcement condition.

3. Ss in the modeling condition will have higher post-test IQs than will Ss in the reinforcement condition.

4. Ss trained with the Concept Development Program (experimental groups) will have higher post-test IQs than Ss who have not received this concept training (control group).

Method

Subjects

The twenty-four Ss included in this study were children ranging in age between three and five years who attended the Denton Christian Preschool, operated five mornings each week in the Trinity Presbyterian Church of Denton, Texas. The study was conducted during the Spring semester (February through May), 1973. Sixteen children (five boys and eleven girls) were randomly assigned to the experimental groups and eight children (four boys and four girls) to the control group. The mean CA of Ss in the modeling group at the outset of the study was 54.0 months, (SD = 7.55). The mean CA for Ss in the reinforcement group at the outset of the study was 52.38 months, (SD = 6.91). For Ss in the control group, the mean CA was 51.88 months, (SD = 8.36). Prior to this study, concept development training had not been part of the preschool curriculum.

The Denton Christian Preschool serves the children of families who earn an annual income within the poverty range as defined by federal guidelines (under $3000 per family of four). Included in this study were sixteen Black, five White, and three Mexican-American children, see Table 1.

Table 1

Sex and Racial Composition of Ss
in the Experimental and Control Groups

	Male	Female	Black	Mexican American	White
Control Group (n=8)	4	4	6	--	2
Reinforcement Group (n=8)	2	6	6	1	1
Modeling Group (n=6)*	2	4	4	2	2

*Two Ss (1 Black male and 1 White female) who were assigned to this group but who did not complete the CDP, are not included in this Table.

None of the children included in the sample was physically disabled and all spoke clearly enough to be easily understood. The sample as described above included all the children attending the preschool during the Spring semester, 1973, with the exception of three children who were enrolled in speech therapy sessions and therefore unavailable for inclusion in the study on a daily basis. The decision to exclude these children from the sample before random assignment to experimental and control groups was also based on the fact that the IQ test used is not recommended for use with speech-impaired children.

Experimenters

The author was experimenter (E) in this study and had not, prior to this research project, been acquainted (either personally or through written records) with any of the Ss. So that she would be accepted by the children as a friendly and rewarding adult, E played with them in the capacity of volunteer helper for several days prior to initial IQ testing and introduction of her revision of the CDP. Two regular volunteers at the preschool (one male and one female) served as additional Es for the modeling condition. Either one or the other of these volunteers assisted regularly with the same child, in order to maintain a constancy throughout training for each individual S.

A randomized groups design was used in the present study. Analysis of covariance with initial (pre-test) IQ scores as the covariate and post-test IQ scores as the dependent measure was used to determine whether there was a significant effect due to the differential treatments (reinforcement, modeling, and control). The significance of the post-test mean differences was evaluated by means of Tukey's Honestly Significant Difference (HSD) test.

By a random selection of names from an alphabetically arranged class role, eight Ss were assigned by E to the control group. This assignment was made before E was introduced to any of the children. Each of the control Ss was given the Slosson Intelligence Test (SIT) twice, with an interval of approximately three months between initial and post-test administrations. These Ss were given no adaptation to the concept problems and received no concept training during the interval between administrations of the SIT.

The two experimental treatment groups used in this study were termed reinforcement and modeling. A feedback condition employed in the Jacobson et al. study was not replicated. For Ss in the reinforcement group, each correct response was rewarded with verbal praise and an M&M candy. When an incorrect response was made, the Ss was told that he was incorrect and he was not rewarded for this response.

In the modeling group the E demonstrated (or modeled) ten correct responses for each S before the series of twenty acquisition trials was begun. In order to maintain his attention, the S was also reinforced twenty-five percent of the time that he saw the model (E) being reinforced with verbal praise and an M&M candy. The model's responses were always correct. After this initial demonstration of each problem, Ss in the modeling group were rewarded for correct responses just as were Ss in the reinforcement group. When an incorrect response was made, Ss in the modeling group were told that they were incorrect, and no reward was given.

Procedure

The Es worked with Ss in both groups to help them acquire the behavioral skills necessary for successful participation in the CDP. Such skills included sitting still in the chair and looking directly at the concept board, pointing on cue to the stimulus, looking at both stimuli before responding, and attending to the task. Within the limits of experimental procedure, the Es maintained a warm and friendly relationship with each of the Ss throughout the course of concept training.

An adaptation period preceded training on the first six concept problems. During adaptation the S was asked to point on cue to three consecutive instances of the desired concept. This procedure assured that each S clearly understood the concept he was being asked to select.

During the baseline period following adaptation for problems one through six, Ss in both experimental treatment groups were asked to point to each of ten correct examples of the stimulus dimension. This was a baseline because it served to indicate the S's correct response level for the concept prior to learning set acquisition. In order to maintain motivation and attention, three of the S's correct baseline responses were reinforced with verbal praise and an M&M candy. At the time he was rewarded, the S was told that his choice was correct.

The correct concept (e.g. yellow) was presented on each of the twenty learning trials which constituted the concept problems in the Jacobson et al. study. This procedure was followed for the one and two dimensional concept problems in the revised CDP. Due to a procedural error, however, the children were not asked to select the same three-dimensional concept for twenty consecutive trials on the last six concept problems. Instead they were presented with a random series of three-dimensional discrimination problems. For example, although the thirteenth concept problem is called "small-green-square", this was not the correct answer for each trial presented. Ss in both experimental treatment groups therefore had no chance to acquire a discrimination learning set on the three-dimensional concept problems.

Alternative stimuli in the two-choice discrimination problems consisted of any of the other possible concepts varied randomly. (See Appendix for a listing of all the problems presented in the revised CDP.)

A different set of stimuli was used for each problem, and the left-right position of the correct stimulus was varied from trial to trial. The size dimension (big, little) was included as a stimulus choice but not presented among the one-dimension concept problems at the outset of training.

All Ss began with the first of the one dimension problems and continued through the two and three dimension problems of the CDP, (see Table 2).

Table 2

Learning Set Problems Presented During the Revised Concept Development Program

One - dimension problems:	
1.	yellow
2.	circle
3.	blue
4.	green
5.	square
6.	triangle
Two - dimension problems:	
7.	red - square
8.	small - triangle
9.	big - green
10.	big - square
11.	yellow - triangle
12.	blue - square
Three - dimension problems:	
13.	small - green - square
14.	big - blue - circle
15.	small - red - triangle
16.	big - yellow - circle
17.	big - green - square
18.	small - blue - triangle

The one and two dimension problems differed only in level of complexity, and for each type of problem the Ss were instructed to "Point to the (desired concept) ", for example, "blue square." As in the original CDP, a common strategy or learning set was required for solution of these concept problems. For the three dimension concept problems, Ss in both experimental treatment groups tried to select the correct of two concepts presented for a series of twenty trials. The instruction, "Point to the ______", varied on each trial presented.

A S was considered to have reached criterion on any one concept if he pointed to the correct stimulus ten consecutive times in one trial block of ten concept instances, or at least eight times during each of two consecutive blocks of ten instances. If a S pointed to the correct stimulus on all ten concept instances presented during the baseline period, he would begin adaptation on the next concept problem. However, if he failed to reach criterion during the baseline period for problems one through six, he would begin the acquisition period and continue on the same concept problem until the learning set criterion was met. Unlike many learning set experiments with young children, Ss were not eliminated from this study for failure to solve the initial problems correctly.

The length of the training sessions was short at first, usually less than ten minutes. As the childrens' ability and attention span permitted, the training sessions were gradually extended. Jacobson et al. reported training sessions lasting an hour, whereas in this study the longest sessions were approximately thirty minutes in length.

Instruments

The CDP used in this study includes eighteen two-choice discrimination problems involving one, two, or three stimulus dimensions. The concept problems were adapted from the first eighteen problems in the original CDP, and include the following dimensions and attributes:

Dimension	Attribute
color	red, green, blue, yellow
size	big, small
shape	circle, square, triangle

This program represents a substantial modification of the original CDP (Jacobson et al., 1971). As discussed earlier, the three dimension concept problems did not require the same solution for all twenty trials and therefore Ss were not working to acquire a particular learning set. Also, the adaptation and baseline procedures preceded learning of each concept in the Jacobson et al. study, but were used only for the first six concept problems in the revised CDP. The attribute "large" was changed to "big" at the suggestion of teachers that this word was more commonly used in current early childhood materials. The quantity dimension (one, two) was eliminated entirely.

Since the children were already familiar with the numbers one and two, it was decided that their attention should be focused on other dimensions with which they were unfamiliar at the outset of the training program. This also removed the possibility of guessing on the basis of number alone. Due to considerations of time, the position dimension (left, right) was also not included in the revised CDP.

The concept board consisted of two rather than three panels against which the stimulus shapes and colors were displayed because, without the position dimension, a middle panel was unnecessary.

The Slosson Intelligence Test (SIT)

The SIT, devised by Richard L. Slosson and published by Slosson Educational Publications, East Aurora, New York, includes many items adapted from the 1960 revision of the SB-LM. The SIT was selected for use in this study when it was discovered that many of the preschool children had been given the SB-LM earlier in the year. The SIT proved to be an excellent measuring device for purposes of this study for the following reasons; it correlates highly with the SB-LM and yet is much easier to administer, has a lower base for children, and takes only ten to thirty minutes to administer and score.

Correlation between the SIT and the SB-LM is reportedly .90 for preschool children four years of age. Reliability coefficients ranging between .70 and .90 were reported for the SIT and the Peabody Picture Vocabulary Test, the Houston Test of Language, and the

Vineland Social Maturity Scale. The specific age groups for these correlations was not reported, (Slosson, 1963).

Perceptual-motor items, which are included at the lower age levels of the SIT, phase out at 7-0 when the test becomes primarily auditory-vocal. Test items for children under four years of age are adapted from the Gessell Developmental Studies as well as from the SB-LM. The SIT is not recommended for Ss with noticeable speech defects.

A reliability coefficient of .97 for test-retest within a period of two years is reported for this test (Hammil, 1968). This coefficient was reported from a study involving individuals ranging in age between four and fifty years. Only non-English speaking individuals were excluded from the standardization sample, which claims to include Ss from all racial, ethnic, and socioeconomic groups.

Results

It was hypothesized that the higher the initial (pre-test) IQ score, the more rapid would be the acquisition of learning sets. Rate of acquisition of learning sets was calculated by counting the number of 10-trial blocks to criterion over the entire eighteen problem CDP. The fewer the total trials to criterion on the eighteen problems for a given S, the more rapid was his acquisition of learning sets. A Pearson produce-moment correlation computed on the observed data indicates that there was no significant relationship ($r = -0.02$) between these variables, and therefore this hypothesis was not substantiated. Knowledge of a S's initial (pre-test) IQ did not predict his rate of acquisition of learning sets.

It was also hypothesized that the modeling technique would result in more rapid acquisition of learning sets than would a reinforcement technique employed without modeling. However, over the eighteen problem CDP there was no significant difference in the rate of acquisition of the learning sets for the two experimental treatment groups, [$t\ (df = 12) = -.008,\ P > .05$]. Table 3 shows the means and standard deviations for 10-trial blocks to criterion for Ss in both experimental treatment groups.

Table 3

Means and Standard Deviations for
10-Trial Blocks to Criterion

Treatment Group	Mean	S D
Reinforcement Group (n = 8)	36.00	13.00
Modeling Group (n = 6)	35.83	12.40
Total (n = 14)	35.93	12.29

Figure 1 shows the mean number of 10-trial blocks necessary for Ss in the modeling and reinforcement groups to reach criterion for each of the eighteen problems presented during the revised CDP.

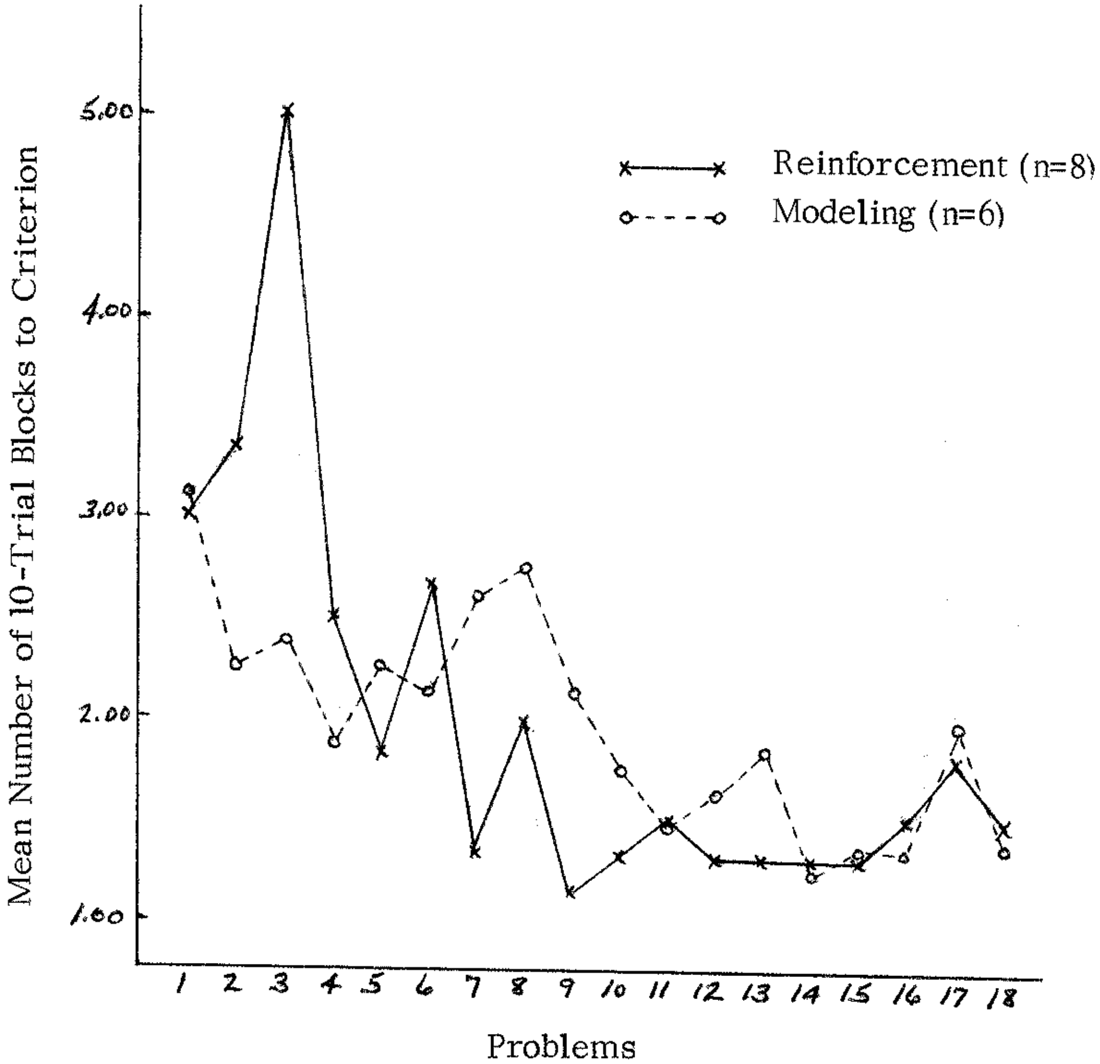

Fig. 1 - Mean number of 10-trial blocks to criterion for Ss in both experimental groups

This figure illustrates that in the early problems there was an apparent difference in the number of 10-trial blocks to criterion between the two experimental treatment groups. During this phase of the CDP, Ss in the modeling group required a greater number of 10-trial blocks to criterion than did Ss in the reinforcement group. Over the eighteen problem CDP, however, the difference in rate of acquisition of learning sets for the two groups was negligible.

Since the mean pre-test IQ scores do not differ significantly for the three groups, (see Table 4), the random assignment of Ss to the two experimental treatment and one control condition was successful.

Table 4

Means and Standard Deviations
for Initial (Pre-test) IQ Scores

Treatment Group	Mean	S D
Reinforcement Group (n = 8)	97.38	13.38
Modeling Group (n = 6)	103.50	17.76
Control Group (n = 8)	106.13	17.51
Total (n = 22)	102.23	15.88

A one-way analysis of covariance using the initial (pre-test) IQ scores as the covariate and the post-test IQs as the criterion measures indicated a significant effect due to the differential treatment conditions [F (df = 2/18) = 4.22, $P < .05$].

Application of Tukey's HSD Test shows a significant superiority of the control group as compared with the modeling group ($P < .05$). No other significant differences between groups were found, although the control group had non-significantly higher post-test IQs than the reinforcement group. The third hypothesis that Ss in the modeling condition would have higher post-test IQs than would Ss in the reinforcement condition was not supported, (see Table 5).

Table 5

Means and Standard Deviations for Post-test IQ Scores

Treatment Group	Adjusted Mean	S D
Reinforcement Group (n = 8)	100.88	10.08
Modeling Group (n = 6)	96.50	12.37
Control Group (n = 8)	110.13	14.33
Total (n = 22)	103.05	13.11

Table 5 also illustrates that neither the reinforcement nor the modeling condition was more effective in raising IQ test scores than was simple continuation in the regular preschool program, rather the opposite occurred. The fourth hypothesis that Ss trained with the CDP (experimental groups) would have higher post-test IQs than Ss who have not received this concept training (control group) was not supported by the results of this study noted above.

Discussion

This study was proposed as a replication of part of the CDP devised by Jacobson et al. (1971) to assess the affects of learning set acquisition on the cognitive skills of disadvantaged preschool children. None of the relationships reported by Jacobson et al. were duplicated, possibly due to differences between this and the original CDP. These differences are discussed in the following paragraphs.

The eighteen problem CDP used in this study represented a considerably shortened version of the original forty-four concept training problems. With the left-right position dimension eliminated, the stimulus choices were far easier than in the original program; perhaps too easy to allow Ss to benefit from their reinforced successes. The literature on learning set acquisition suggests that IQ differences between groups have been less pronounced when the discrimination learning tasks were rather simple. It is also possible that a certain level of problem complexity must be reached before significant differences between the experimental conditions, as reported by Jacobson et al., will be demonstrated.

Due to a procedural error, the children were presented with a random series of concept instances rather than the three dimension problems thirteen through eighteen in the revised CDP. In the study by Jacobson et al., the correct concept was presented on all twenty concept instances which constituted each of the three-dimension problems. This change in procedure for the three-dimension problems may have confused the Ss in both experimental treatment groups. Had these problems required a common basis for solution (acquisition of a learning set) as did the one and two dimension problems, results similar to those reported by Jacobson et al. may have been found.

The M&M candy may have been a more distracting reward than the frosted cereal used in the original study. The Ss tried to collect different colors of candy and often sorted and arranged the candies in rows. This activity may have directed their attention away from the concept problems. As training progressed, the Ss' attention seemed to focus more and more on reward-getting.

Extraneous variables such as noise, distraction by other students, and traffic through the area may also have contributed to the inconsistent results obtained.

A number of investigators including Jacobson et al. have found that differences in rate of learning set acquisition are positively associated with intelligence level. If Ss trained with the revised CDP had been able to demonstrate increased intellectual functioning as measured by the post-training administration of the SIT, then some conclusion might have been drawn from this study regarding the effectiveness of concept training for disadvantaged preschool children. The finding of the present study, that the revised CDP interfered with IQ improvement, should not be interpreted as evidence against the effectiveness of the original CDP as devised by Jacobson et al. The present CDP was much simpler and not presented in a procedurally correct manner. On the basis of the favorable results reported by Jacobson et al., it is r ecommended that additional studies be made using the number of problems presented as independent variable. The results of the present study suggest that task complexity (a function of program length) may be as important a consideration as any other cognitive and motivational variables involved in the concept training. It is also suggested that in future studies the three experimental conditions be matched on the basis of initial (pre-test) IQ at the outset of concept training for Ss in the experimental treatment groups.

Many teachers and volunteer aides at the preschool noted an increased willingness on the part of the children to attend to learning tasks subsequent to their participation in the CDP. Improved performance in the classroom is an important effect of this and similar concept training programs for preschool aged children.

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APPENDIX

Problems Presented During the Revised Concept Development Program

1 - Yellow

1. small, yellow triangle
2. big, red, triangle
3. big, green, square
4. big, blue, square
5. small, yellow, circle
6. big, green, triangle
7. big, yellow, triangle
8. big, red, circle
9. small, yellow, square
10. small, yellow, square
11. big, yellow, square
12. small, yellow, circle
13. small, red, triangle
14. big, yellow, triangle
15. big, yellow, circle
16. big, yellow, triangle
17. big, blue, triangle
18. small, red, triangle
19. big, yellow, square
20. big, yellow, square

1. small, blue, circle
2. big, yellow, square
3. big, yellow, triangle
4. big, yellow, square
5. big, blue, square
6. small, yellow, triangle
7. small, green, triangle
8. big, yellow, circle
9. big, blue, circle
10. big, red, circle
11. small, green, circle
12. big, blue, square
13. small, yellow, circle
14. big, red, triangle
15. small, green, circle
16. small, red, square
17. small, yellow, square
18. small, yellow, triangle
19. big, red, triangle
20. small, yellow, square

2 - Circle

1. big, green, triangle
2. big, yellow, triangle
3. small, yellow, circle
4. big, red, triangle
5. big, red, circle
6. small, green, circle
7. big, yellow, circle
8. small, blue, circle
9. small, yellow, square
10. big, green, circle
11. big, green, triangle
12. small, blue, triangle
13. big, red, triangle
14. small, yellow, circle
15. big, blue, square
16. big, red, circle
17. small, green, circle
18. small, blue, triangle
19. small, blue, circle
20. big, blue, triangle

1. small, blue, circle
2. small, green, circle
3. small, red, square
4. big, red, circle
5. small, blue, square
6. small, yellow, square
7. small, green, square
8. small, blue, triangle
9. small, blue, circle
10. big, yellow, square
11. big, red, circle
12. big, green, circle
13. big, blue, circle
14. small, yellow, triangle
15. small, red, circle
16. small, green, triangle
17. small, red, square
18. small, blue, circle
19. small, yellow, square
20. small, red, circle

3 - Blue

1. big, green, square
2. small, blue, triangle
3. big, yellow, triangle
4. big, red, circle
5. big, yellow, triangle
6. big, blue, triangle
7. big, blue, circle
8. big, blue, square
9. small, red, square
10. small, blue, square
11. small, blue, triangle
12. small, blue, circle
13. big, blue, circle
14. small, green, triangle
15. small, yellow, triangle
16. big, red, triangle
17. small, blue, triangle
18. small, yellow, circle
19. big, blue, square
20. big, blue, triangle

1. small, blue, square
2. small, red, square
3. big, blue, square
4. big, blue, circle
5. big, blue, square
6. big, red, triangle
7. big, green, circle
8. big, yellow, square
9. big, blue, square
10. big, yellow, circle
11. big, green, triangle
12. big, red, circle
13. big, red, circle
14. small, blue, triangle
15. small, blue, square
16. small, blue, circle
17. big, yellow, square
18. small, blue, circle
19. small, red, triangle
20. small, green, square

4 - Green

1. small, green, circle	1. small, red, circle
2. small, green, triangle	2. small, blue, circle
3. small, blue, circle	3. small, green, triangle
4. big, green, triangle	4. big, red, triangle
5. small, green, square	5. big, red, triangle
6. big, yellow, square	6. big, green, square
7. big, yellow, circle	7. big, green, square
8. small, yellow, circle	8. small, green, circle
9. small, red, square	9. big, green, circle
10. small, yellow, square	10. big, green, triangle
11. big, green, circle	11. big, blue circle
12. big, blue, triangle	12. big, green, square
13. big, green, circle	13. small, green, square
14. small, green, square	14. small, red, square
15. small, yellow, triangle	15. big, green, circle
16. small, green, triangle	16. big, green, triangle
17. big, yellow, circle	17. small, green, circle
18. small, red, square	18. small, green, square
19. small, green, triangle	19. big, yellow, square
20. big, green, circle	20. small, blue, square

5 - Square

1. small, blue, square	1. small, green, triangle
2. small, green, triangle	2. small, red, square
3. small, green, square	3. small, yellow, triangle
4. small, blue, triangle	4. small, blue, square
5. big, red, circle	5. small, yellow, square
6. small, yellow, square	6. small, yellow, triangle
7. big, green, square	7. small, blue, circle
8. small, red, square	8. small, red, circle
9. big, yellow, circle	9. small, green, square
10. big, blue, triangle	10. big, yellow, square
11. small, yellow, circle	11. big, red, square
12. big, green, square	12. big, red, triangle
13. big, yellow, square	13. small, green, triangle
14. small, red, triangle	14. small, red, square
15. big, yellow, triangle	15. small, blue, square
16. small, green, square	16. big, red, triangle
17. big, blue, circle	17. big, green, square
18. big, yellow, square	18. big, yellow, triangle
19. big, yellow, circle	19. big, red, square
20. big, blue, triangle	20. small, red, square

6 - Triangle

1. small, blue, triangle	1. small, green, square
2. big, yellow, square	2. big, red, triangle
3. small, red, triangle	3. big, blue, circle
4. big, green, triangle	4. big, green, square
5. small, red, circle	5. small, yellow, triangle
6. small, blue, triangle	6. small, green, circle
7. big, yellow, circle	7. big, blue, triangle
8. small, yellow, square	8. small, yellow, triangle
9. big, green, triangle	9. big, red, circle
10. small, yellow, square	10. big, red, triangle
11. big, red, triangle	11. big, yellow, square
12. small, red, square	12. big, blue, triangle
13. small, green, square	13. small, red, triangle
14. big, yellow, circle	14. big, yellow, triangle
15. small, green, triangle	15. big, red, square
16. small, yellow, circle	16. big, red, triangle
17. small, yellow, triangle	17. big, red, circle
18. small, blue, triangle	18. small, blue, square
19. small, yellow, square	19. small, red, triangle
20. big, blue, triangle	20. small, green, circle

7 - Red - Square

1. small, red, square	1. big, blue, triangle
2. big, green, circle	2. big, red, square
3. big, red, square	3. small, yellow, square
4. small, red, square	4. small, green, square
5. small, blue, circle	5. big, red, square
6. big, red, square	6. small, red, triangle
7. big, green, triangle	7. small, red, square
8. big, red, circle	8. big, red, square
9. small, red, square	9. big, yellow, square
10. small, blue, triangle	10. big, red, square
11. small, red, square	11. big, red, circle
12. big, red, square	12. big, yellow, square
13. small, green, triangle	13. small, red, square
14. small, red, square	14. small, red, triangle
15. big, blue, square	15. big, red, square
16. big, red, square	16. big, green, circle
17. big, red, square	17. small, red, triangle
18. small, blue, square	18. small, red, square
19. small, red, square	19. big, green, square
20. small, red, triangle	20. big, red, square

8 - Small - Triangle

1. small, yellow, triangle	1. big, blue, circle
2. small, blue, triangle	2. small, green, square
3. big, red, circle	3. small, red, triangle
4. small, green, triangle	4. big, green, triangle
5. small, red, square	5. small, yellow, triangle
6. small, blue, triangle	6. small, green, circle
7. big, blue, square	7. small, red, triangle
8. small, green, circle	8. small, green, triangle
9. small, red, triangle	9. big, blue, triangle
10. small, red, circle	10. small, blue triangle
11. small, green, square	11. small, yellow, triangle
12. big, green, triangle	12. small, blue, triangle
13. small, yellow, triangle	13. big, blue, circle
14. small, red, triangle	14. small, red, square
15. small, green, square	15. small, blue, triangle
16. small, red, triangle	16. big, yellow, circle
17. big, blue, triangle	17. small, green, triangle
18. small, yellow, triangle	18. big, yellow, triangle
19. small, yellow, triangle	19. big, green, square
20. small, yellow, triangle	20. small, red, triangle

9 - Big - Green

1. big, green, triangle	1. small, blue, square
2. big, blue, circle	2. big, green, circle
3. big, green, square	3. small, red, square
4. big, blue, circle	4. big, green, circle
5. big, green, triangle	5. small, red, circle
6. small, red, square	6. big, green, circle
7. big, green, circle	7. big, blue, square
8. small, green, triangle	8. big, green, square
9. small, green, square	9. big, green, triangle
10. big, green, square	10. big, yellow, triangle
11. big, green, triangle	11. small, red, circle
12. big, blue, circle	12. big, green, circle
13. big, green, square	13. small, blue, triangle
14. big, yellow, triangle	14. big, green, triangle
15. small, red, square	15. big, green, circle
16. big, green, square	16. small, blue, circle
17. big, green, triangle	17. big, yellow, square
18. small, green, triangle	18. big, green, triangle
19. big, green, triangle	19. small, red, circle
20. big, blue, triangle	20. big, green, circle

10 - Big - Square

1. big, green, square
2. big, yellow, triangle
3. big, green, square
4. big, red, square
5. small, green, circle
6. big, yellow, square
7. big, yellow, circle
8. small, green, square
9. big, yellow, square
10. big, blue, square
11. big, blue, triangle
12. big, red, square
13. big, yellow, triangle
14. big, green, square
15. big, red, square
16. big, blue, square
17. small, blue, square
18. big, yellow, square
19. big, red, circle
20. small, yellow, square

1. small, blue, triangle
2. big, blue, square
3. small, red, square
4. small, red, square
5. big, yellow, square
6. small, red, triangle
7. big, yellow, square
8. big, green, triangle
9. big, red, circle
10. small, yellow, triangle
11. big, green, square
12. small, red, square
13. big, green, square
14. big, green, triangle
15. big, green, circle
16. big, red, triangle
17. big, green, square
18. small, yellow, square
19. big, green, square
20. big, blue, square

11 - Yellow - Triangle

1. big, yellow, triangle
2. big, red, square
3. big, yellow, triangle
4. small, yellow, triangle
5. small, green, square
6. big, yellow, triangle
7. small, yellow, triangle
8. big, red, triangle
9. big, blue, square
10. big, yellow, triangle
11. big, green, circle
12. small, yellow, triangle
13. big, yellow, triangle
14. small, green, triangle
15. big, yellow, triangle
16. small, red, square
17. big, blue, triangle
18. big, yellow, triangle
19. small, green, circle
20. small, blue, triangle

1. small, blue, square
2. small, yellow, triangle
3. small, blue, circle
4. small, yellow, square
5. big, yellow, triangle
6. big, blue, triangle
7. small, yellow, triangle
8. big, yellow, triangle
9. small, yellow, triangle
10. small, green, triangle
11. big, yellow, triangle
12. small, blue, triangle
13. big, blue, triangle
14. small, yellow, triangle
15. small, red, triangle
16. small, yellow, triangle
17. big, yellow, triangle
18. big, yellow, circle
19. small, yellow, triangle
20. small, yellow, triangle

12 - Blue - Square

1. small, blue, square
2. big, green, circle
3. big, blue, square
4. small, blue, square
5. small, red, circle
6. big, blue, square
7. big, green, triangle
8. big, blue, square
9. small, blue, square
10. small, red, triangle
11. small, blue, square
12. big, blue, square
13. small, green, triangle
14. small, blue, square
15. big, blue, square
16. big, blue, square
17. big, blue, square
18. small, blue, square
19. small, red, square
20. small, red, triangle

1. big, red, triangle
2. big, blue, square
3. small, yellow, square
4. small, blue, triangle
5. big, blue, square
6. small, red, triangle
7. small, blue, square
8. big, red, square
9. big, yellow, square
10. big, blue, square
11. big, red, circle
12. big, yellow, square
13. small, blue, square
14. small, blue, triangle
15. big, red, square
16. big, yellow, circle
17. small, red, triangle
18. small, blue, circle
19. big, blue, square
20. big, blue, square

13 - Small - Green - Square

1. big, blue, circle
2. small, green, square
3. small, green, square
4. small, red, square
5. small, green, square
6. big, green, circle
7. small, yellow, triangle
8. small, green, square
9. big, red, triangle
10. small, green, square
11. small, green, square
12. big, blue, triangle
13. small, green, square
14. big, green, square
15. small, green, square
16. small, green, square
17. small, yellow, square
18. small, green, square
19. big, yellow, square
20. small, red, circle

1. small, green, square
2. small, blue, circle
3. big, red, triangle
4. small, green, square
5. small, yellow, triangle
6. small, green, square
7. small, green, square
8. small, green, circle
9. small, green, square
10. big, yellow, circle
11. small, yellow, square
12. small, green, square
13. small, blue, circle
14. small, green, square
15. big, red, circle
16. big, blue, circle
17. small, green, square
18. small, green, circle
19. small, green, square
20. small, green, square

14 - Big - Blue - Circle

1. big, blue, circle
2. big, blue, circle
3. small, red, square
4. big, blue, circle
5. big, yellow, square
6. small, blue, triangle
7. big, blue, circle
8. small, red, circle
9. big, blue, circle
10. big, blue, circle
11. big, yellow, triangle
12. small, red, square
13. big, blue, circle
14. big, blue, triangle
15. small, green, triangle
16. big, blue, circle
17. small, red, square
18. big, blue, circle
19. big, red, triangle
20. big, blue, circle

1. small, yellow, triangle
2. big, green, square
3. big, blue, circle
4. big, green, circle
5. big, blue, circle
6. big, blue, circle
7. small, yellow, triangle
8. big, blue, circle
9. big, green, triangle
10. small, blue, square
11. big, blue, circle
12. big, blue, circle
13. big, red, square
14. big, blue, circle
15. big, blue, circle
16. small, blue, square
17. big, blue, circle
18. big, yellow, circle
19. big, blue, circle
20. small, blue, circle

15 - Small - Red - Triangle

1. small, red, square	1. small, red, triangle
2. small, red, triangle	2. big, yellow, circle
3. small, yellow, circle	3. small, red, triangle
4. small, red, triangle	4. big, red, triangle
5. small, red, triangle	5. big, green, circle
6. small, blue, circle	6. small, red, triangle
7. small, red, triangle	7. small, red, triangle
8. big, blue, triangle	8. small, blue, triangle
9. small, yellow, square	9. big, yellow, square
10. big, green, circle	10. small, blue, circle
11. small, yellow, triangle	11. small, red, triangle
12. big, red, triangle	12. big, blue, circle
13. small, red, triangle	13. small, green, square
14. small, red, square	14. small, red, triangle
15. small, red, triangle	15. big, blue, square
16. big, green, circle	16. small, blue, circle
17. small, red, square	17. small, yellow, circle
18. small, red, triangle	18. small, blue, triangle
19. small, green, square	19. small, red, triangle
20. big, blue, circle	20. small, red, triangle

16 - Big - Yellow - Circle

1. big, yellow, circle	1. small, green, triangle
2. small, red, square	2. big, yellow, circle
3. big, yellow, circle	3. big, green, triangle
4. big, yellow, circle	4. big, yellow, triangle
5. small, yellow, circle	5. big, yellow, circle
6. big, yellow, circle	6. big, green, circle
7. small, blue, square	7. big, red, circle
8. big, red, circle	8. small, yellow, circle
9. small, yellow, triangle	9. big, yellow, circle
10. small, blue, square	10. big, yellow, circle
11. big, yellow, circle	11. big, yellow, square
12. big, green, circle	12. big, yellow, circle
13. big, yellow, triangle	13. big, red, square
14. big, green, circle	14. small, yellow, circle
15. small, red, circle	15. small, blue, square
16. big, yellow, circle	16. small, red, triangle
17. big, yellow, triangle	17. big, yellow, circle
18. small, yellow, circle	18. big, yellow, circle
19. big, yellow, circle	19. big, red, circle
20. small, green, square	20. big, yellow, circle

17 - Big - Green - Square

1. big, green, square	1. big, red, circle
2. big, red, square	2. small, green, square
3. small, yellow, square	3. big, green, square
4. big, green, square	4. big, green, triangle
5. small, blue, circle	5. big, yellow, square
6. big, yellow, square	6. big, red, triangle
7. big, green, circle	7. big, red, square
8. small, yellow, square	8. big, yellow, square
9. big, yellow, circle	9. big, green, square
10. big, green, square	10. small, red, square
11. small, green, triangle	11. big, blue, square
12. big, red, square	12. big, yellow, circle
13. big, yellow, square	13. small, yellow, square
14. big, green, square	14. big, green, triangle
15. big, blue, square	15. small, green, square
16. big, green, triangle	16. big, red, circle
17. small, red, square	17. big, green, square
18. big, red, square	18. big, red, square
19. big, blue, square	19. small, blue, triangle
20. big, green, square	20. small, red, square

18 - Small - Blue - Triangle

1. small, blue, triangle
2. small, red, circle
3. big, green, square
4. small, blue, triangle
5. big, yellow, circle
6. big, blue, square
7. small, blue, triangle
8. small, yellow, square
9. big, green, circle
10. big, red, square
11. small, blue, triangle
12. small, green, circle
13. big, red, square
14. big, green, triangle
15. small, blue, circle
16. big, yellow, square
17. small, yellow, square
18. small, blue, triangle
19. big, red, circle
20. small, green, square

1. small, red, triangle
2. small, blue, triangle
3. small, green, triangle
4. small, yellow, triangle
5. small, red, triangle
6. small, blue, triangle
7. small, yellow, triangle
8. small, green, triangle
9. small, red, triangle
10. small, yellow, triangle
11. big, red, square
12. small, yellow, circle
13. small, blue, triangle
14. big, green, circle
15. big, red, triangle
16. small, blue, square
17. small, red, triangle
18. small, blue, triangle
19. big, yellow, square
20. big, green, circle