has been arranged. For each test item three stimuli are presented, only one of which is classified as the correct response -- the "biggest" one of the three stimuli. Since the stimuli in each item consist of the same picture or three-dimensional object in three sizes, six arrangements of the stimuli are possible. In order to avoid position or pattern sets, each item was assigned at random to one of the six pattern arrangements.

The following explanation was given to introduce the test:

> We are going to play a game. Listen carefully to what I say. On each card you show me the biggest picture. When you find the biggest one you will get a candy in this jar. If you don't find the biggest one, you will not get a candy. Ready...here's the first one.... Show me the biggest one. Put your finger on the biggest ______(name of object or picture).

The last two sentences were the directions for each test item in Series A, B, C, and D. One M&M candy was given as the reward for each correct response.

Series A. The five items in this series are outline pictures of the following familiar objects: cats, tables, caps, cars, and girls. On each card there are three pictures of the object, e.g., Card 1 contains three cats identical in all respects except size.

Series B. These five items are outlines of geometric forms: rectangles, ovals, triangles, stars, and diamonds.

Series C. These five items are three-dimensional familiar objects: spoons, shoes, cake pans, trees, and lemons.

Series D. These five items are three-dimensional geometric forms: square, circular, triangular, and rectangular solids, and pyramids.

Series E. In this series a correct response requires the selection of the picture or object that corresponds with the directions given with each item. The correct response is always the biggest picture or object.

The items and directions for this series are as follows:

Item 1. A jar and three caps of different sizes.

Directions: "Which cap fits this jar?"

Item 2. A white card with a blue outline of a square, and three squares of blue paper varying in size.

Directions: "Which of these is just like this one?"

Item 3. A nest of three cubes and three additional cubes of varying size, one of which correctly completes the nest sequence.

Directions: "Watch...this one goes in here, and these go in here. (The examiner performs the activity.) Which one will they fit into next?"

Item 4. A standing paper doll, and three cut-out coats, identical in color and style, but in three sizes.

Directions: "Which coat fits the dolly?"

Item 5. A string of large beads, and three separate beads of different sizes.

Directions: "Which bead is the same as these?"

Scores on this test are the total number of correct responses which a child makes to the test items. The first picture or object which a child selected was recorded as his response, unless he spontaneously changed his response, or corrected an error. The size of the object or picture selected was recorded by the investigator on a separate record sheet (See Appendix C). The number of correct responses on each subtest series was also tabulated. Since there are 25 items in the test, the minimum score significantly better than chance at the .01 level is 15. Therefore 14 was used as the cut off score for inclusion of subjects in the study.

Preliminary testing with the Size Concept Test was conducted with a group of 25 children of normal intelligence who ranged in age from 2 years-2 months to 4 years-7 months. An odd-even split of the 25 items yielded a split-half reliability coefficient of .94 and a Spearman-Brown reliability coefficient of .97 for the total test. A progressive increase in the number of correct responses appeared to be related to increasing chronological age. A pilot study with the Size Concept Test and the training materials with a small group of mongoloid children was also conducted to determine its effectiveness with mongoloid children.

The training materials consisted of 10x15-inch cards arranged in four sets of 14 cards each. On each card black outline pictures were drawn as stimuli.

Set 1. Black outlines of familiar objects. In selecting pictures for these training sets the pictorial materials used in standard intelligence tests were surveyed. It was decided that pictures similar to, but not identical with, those used at the lower levels of the Kuhlmann Tests and the Stanford-Binet Forms L and M would be appropriate. Suitable pictures were also chosen from readiness books and workbooks used in nursery schools and pre-primary classes. These were projected and enlarged for use in this study. Set 1 includes pictures of the following objects: ball, man, cup, tree, boat, horse, chair, dog, bird, key, airplane, apple, shoe, and teddy-bear. Each card has one picture on it. The response to be learned by the subject is the action of pointing to the object, or placing his finger on it. The instructions for this set are: "Put your finger on this. Put your finger on the ______(name of the object in picture)." When a subject responded correctly, he was rewarded verbally and with an M&M candy, before he proceeded to the next card. If a subject did not respond correctly, the examiner encouraged him to imitate her action by putting her finger on the picture and by saying: "You put your finger on too."

Set 2. On each card in this set th
large and small picture of the same obj
position of each size was randomly ass
avoid position responses. The directio
two subsequent sets are: "Show me the
your finger on the big (biggest)______
ture)." Each correct response was rew
candy before the subject proceeded to th
ject did not select the biggest picture hi
by the examiner in the following manner
big (biggest) one. This is the big (bigge
finger on the big (biggest)______(name
ing this the examiner pointed to the cor
the subject to do likewise.

Set 3. In this set the same picture
used in Set 2 are presented with a third
card. This third picture is one of the s
used on another card.

Set 4. In this set three pictures of
sented on each card, a large, intermedi
ture of the same objects used in the earl

The subject continued learnin
sponded to 10 out of 14 consecutive ite

NC80-63C

ERIC REPORT RESUME

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CONCEPT FORMATION IN CHILDREN WITH DOWN S SYNDROME-MONGOLISM.
O HARE, SISTER G.
EYC16652 FORDHAM UNIVERSITY, BRONX, NEW YORK
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*RETARDED CHILDREN, MENTAL RETARDATION, SPECIAL EDUCATION, *SIZE DISCRIMINATION, *CONCEPT TEACHING, *CONCEPT FORMATION, CHILD DEVELOPMENT, LEARNING PROCESSES, TRANSFER OF TRAINING, *INDIVIDUAL INSTRUCTION, BRONX, NEW YORK

A SPECIAL TRAINING PROGRAM IN SIZE DISCRIMINATION WAS STUDIED AS A MEANS FOR TEACHING REGULAR TRISOMIC MONGOLOIDS. BASED UPON THE SUCCESS OF THIS PROGRAM, A FURTHER ASSESSMENT WAS MADE AS TO ACQUIRED SIZE DISCRIMINATION ABILITY OF SUCH PERSONS WHEN TRANSFERRED TO OTHER LEARNING TASKS WITH PICTORIAL MATERIALS AND THREE-DIMENSIONAL OBJECTS. THE SUBJECTS WERE 60 NON-INSTITUTIONALIZED MONGOLOID CHILDREN (CONFIRMED BY CHROMOSOMAL ANALYSIS) WITH A MEAN AGE OF 6 YEARS AND AVERAGE I.Q. OF 38. A "SIZE CONCEPT TEST" AND SIZE DISCRIMINATION TRAINING TASKS WERE DEVELOPED AND USED WITH THESE CHILDREN. PICTURES, GEOMETRIC FORMS, AND THREE-DIMENSIONAL OBJECTS WERE USED FOR THE TEST WHERE SUBJECTS SELECTED THE "BIGGEST" STIMULUS OUT OF THREE CHOICES FOR EACH TEST ITEM IN RESPONSE TO VERBAL DIRECTION. ONE CANDY WAS THE REWARD FOR EACH CORRECT ("BIGGEST") RESPONSE. THE TRAINING PROGRAM CONSISTED ENTIRELY OF PICTORIAL MAT LS ARRANGED ON CARDS WHERE THE SUBJECTS AGAIN SELECTED THE "BIGGEST" OBJECTS AND WERE REWARDED FOR CORRECT RESPONSES, ACCORDINGLY. ALL TESTING AND TRAINING WERE CONDUCTED INDIVIDUALLY BY INVESTIGATOR IN FACE-TO-FACE SITUATIONS. EXPERIMENTAL SUBJECTS WHO RECEIVED TRAINING WERE COMPARED TO A COMPARABLE CONTROL GROUP. BOTH GROUPS WERE GIVEN PRE- AND POST-TESTS AS DESCRIBED ABOVE (THE LATTER RECEIVED NO TRAINING). SIGNIFICANTLY HIGHER GAINS WERE MADE BY THE EXPERIMENTAL GROUP, AND THIS SUCCESS DID NOT APPEAR TO BE RELATED TO MATURATION OR INTELLECTUAL LEVEL. (JH)

CONCEPT FORMATION IN CHILDREN WITH DOWN'S SYNDROME

Grant No. 5-0986-4-11-3

Sister M. Gregory O'Hare, R.S.M.

Fordham University

New York

1966

The project reported herein was supported by the U.S. Department of Health, Education, and Welfare, Office of Education, Division of Handicapped Children and Youth

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INTRODUCTION

During the past decade research in mental retardation has been stimulated by public interest in and concern for the educational and social adjustment of retarded children. Research during this short period of time could not possibly yield an adequate picture of learning, perception, motivation, personality, and language development in the retarded. The gap between developments in laboratory work in the psychology of learning on the one hand and educational practice on the other, which has existed for many years, appears to be narrowing. However, present knowledge does not provide adequate answers to questions regarding the most expedient means of improving learning in the mentally retarded or the most efficient means of teaching them. One of the recommendations of the President's Panel on Mental Retardation was that special attention be given to training techniques so that the concepts, skills, and abilities that retarded children cannot attain spontaneously and incidentally may be attained through training. Even a small modification of behavior or increase in efficiency effected in the severely retarded can be of prime importance in pointing the way to more effective training methods for the child with less severe handicaps. With special programs of teaching it is hoped that retarded children can learn basic concepts at an early age and with such knowledge be better trained and equipped for classes in vocational training.

PROBLEM

Although many well-conducted experimental and exploratory studies on mentally retarded children have been published in recent years, there is a dearth of information on the unique psychological characteristics of young mongoloid children. Engler's description (1949) of the mental characteristics of such children focused on their delayed development of motor skills due to hypotonia; their lack of initiative, energy, and coordination; and their limited vocabulary development. Benda (1960) also noted that mongoloid children demonstrate a general inability to abstract, but when tested for recall of previously learned material they demonstrate good memory ability. The same author issued a caution against applying data reported on institutionalized mongoloids to mongoloid children living in the community. Marked differences in intelligence levels, social competency, motor skills, and emotional adjustment exist between the institutionalized mongoloid and the one who lives in the community with his family, where medical treatment and educational training have been continued over a long period of time. Benda also concluded that mongoloid children should not be trained with other low-grade mentally deficient children who are not capable of much progress, since the mongoloid has dormant possibilities of improvement.

The objective of the present research was to investigate concept formation and transfer in a group of retarded children whose diagnosis as to subtype of mongolism had been confirmed by chromosomal analysis. Since this type of mental deficit was the first disorder in which abnormal chromosomal numbers were demonstrated, it is now possible to establish such a diagnosis in infancy with complete certainty. With earlier diagnosis of this condition and improved medical care, a consequent extension of life span of such children has been predicted. The need for research on the characteristics of the learning processes of children with this diagnosis has assumed greater importance in planning training programs that will facilitate the realization of the potentialities of mongoloid children.

In curricula planned for retarded children (Connor & Talbot, 1964; New York City Bureau for CRMD, 1952), the teaching of the concept of "big, bigger, biggest" has been placed at the Grade I level. Retarded mongoloid children are rarely assigned to classes on this level before the age of eight years. The present study was undertaken to assess the ability of mongoloid children of preschool age to learn the concept of "biggest" by means of a special training program.

OBJECTIVES

The frequency with which mongoloid children give evidence of adequate perception of visually presented materials, but fail to respond appropriately to directions on tasks within their mental age level, has been noted in their performance on standard intelligence tests. Since under standard procedures of test administration it is impossible to determine whether this is a function of task complexity or inability to follow directions, special procedures were needed to attempt a solution to this problem. A Size Concept Test was developed as a pretest and posttest to evaluate the ability of children to select the "biggest one" of three stimuli. Then a specific training program was designed to provide an opportunity for the acquisition of the concept of "biggest." Several principles from programmed instruction were utilized in the selection of the materials and procedures for this training program:

A. Selection of learning materials from the experiential background of young children.

B. Simplification of the stimulus presentation by eliminating irrelevant cues.

C. Provision of separate training in the motor response (pointing) required by the discrimination tasks.

D. Sequential progression by small steps from simple to more complex tasks.

E. Immediate reenforcement of correct responses and correction of errors.

F. Provision of a favorable learning environment, with special consideration for the characteristics of mongoloid children, namely, their social responsivity.

In this way the tasks involved in size concept formation were simplified so as to bring them within the capacity of preschool mongoloid children. By teaching the simplified tasks, it may then be possible to teach mongoloid children the skills required for success on complex tasks.

It was the purpose of this study to evaluate the effectiveness of a specific training program in size discrimination as a means of teaching the concept of "biggest" to preschool mongoloid children. The degree to which such training extends the behavior repertoire of such children in other tasks with pictorial materials and three-dimensional objects was also evaluated.

The specific hypotheses tested were:

I. Mongoloid children who receive training in size discrimination tasks earn significantly higher scores on a Size Concept Test than do children who do not receive this training.

II. Mongoloid children who receive training in size discrimination tasks demonstrate positive transfer effects on test items of greater complexity than the training tasks.

RELATED RESEARCH

Mongolism is the first psychological disorder in which abnormal chromosomal numbers were demonstrated by Lejeune and his co-workers in 1959 (Waisman and Gerritsen, 1964). Although it is now an accepted fact that mongoloids carry an extra chromosome in addition to the normal forty-six chromosomes, the specific mechanism whereby the extra chromosome leads to the multiple defects is not yet clear. The most common chromosomal mechanism leading to Down's Syndrome involves non-disjunction in the formation of the germ cells, with the result that one of the gametes contains two of the number 21 chromosomes. In these cases of "trisomy-21" the mean age of the mother at the birth of the child is significantly older than in control populations, but the mean age of fathers is not increased. The other major mechanism leading to Down's Syndrome involves a translocation of the major part of chromosome 21 to another chromosome. Most commonly chromosome number 15 is involved, resulting in a 15/21 type of translocation. Where such a translocation is found in the affected child, there have been reports of chromosomal abnormalities in the mother, who herself has forty-five chromosomes, one of which is a combination of 15 and 21. A second type of translocation involving chromosome 22 leads to a 21/22 type of translocation, and in this type the translocation is frequently found in the father (Penrose, 1961, 1962). The desirability of distinguishing between trisomic abnormalities and translocation abnormalities in the evaluation of psychological factors in mongoloids has been noted by Jarvik, Falek, and Pierson (1964). Several studies cited by these authors report suggestive evidence of differential behavioral concomitants specific to the type of genetic abnormality present.

In a comparative study with ten translocation mongoloids and ten standard trisomic mongoloids, Gibson and Pozsonyi (1965) reported intellectual, developmental, and psychiatric differences between the two subtypes. The mean intelligence quotient in the translocation group was significantly higher than that of the trisomic group, while greater variability of development in all areas was found in the standard trisomic group.

Girardeau (1959) matched mongoloid subjects and normal children on MA in a study involving a series of object quality discrimination tasks. Although the mongoloid subjects required significantly more trials to attain criterion learning than did the normal children, they demonstrated significant improvement as they progressed from the first problem through the third problem. Only five problems were presented to the subjects in this study. Thus, the possibility of further improvement could not be fully measured. However, the improvement noted during the first three problems was cited as evidence that mongoloid children are capable of forming learning sets when stimuli differ only slightly in form.

O'Connor and Hermelin (1963) have presented data concerning the psychological characteristics of mongoloids in their studies of subnormal speech and thought processes. Basically their work consists of a series of investigations involving different groups of normal children over a wide age range and adult mental defectives matched with the normal children on MA. The authors analyzed the data for presence or absence of specific characteristics or trends manifested by the mongoloids within the general sample of mental defectives. From further investigations of institutionalized mongoloids between the ages of 9 and 15 years, these authors concluded that mongoloids were not unlike normal subjects of the same MA in visual recognition. They were, however, inferior to these normal subjects in tactual recognition. The mongoloid children were also found to be inferior to other mental defectives of the same IQ in tactual recognition. Mongoloids and nonmongoloid defectives did not differ in visual perception, nor in the extent and duration to which they were alerted by visual stimuli, although both groups were less responsive to such stimuli than normal subjects. Another conclusion of this study which has relevance to the present study is that response processes in mongoloid subjects were more seriously handicapped than sensory processes.

A recent study by Bilovsky and Share (1965) investigated the cognitive style of children with Down's Syndrome with respect to their performance on the Illinois Test of Psycholinguistic Abilities. The group of mongoloids ranged in age from 6 years-11 months to 23 years, with a mean age of 13 years-11 months. Their IQ's ranged from 31 to 86, with a mean of 46.6. The patterns of test results indicated that the subjects manifested a marked deficiency in the ability to deal with nonmeaningful symbols. However, the authors noted that the nature of the stimuli and the type of response required on the various tests influenced the subjects' scores. Where the mode of reception was visual or where the mode of expression was motor, the subjects performed well above their overall language score. On tasks where the mode of reception was auditory, and the mode of expression was verbal, the subjects earned scores significantly lower than their general language scores.

In the literature on mongoloids there is only one report on the psychological characteristics of preschool mongoloid children. Thompson (1963) utilized the test results from the administration of the Stanford-Binet Intelligence Scale (Form L) to 29 preschool mongoloids. The mean MA of the group was 2 years-7 months, and the mean IQ was 45. Although no quantitative data were reported in her study, the author presented a qualitative analysis of test results and test behavior by classifying the test items according to the nature and amount of language used in the directions and in the response. Where little or no language was used in the directions and none in the response, the subjects earned their highest scores. However, as the tasks became more complex and dependent on language skills, the children demonstrated poor attention and difficulty in understanding directions. The author offered several specific suggestions to teachers of such children with regard to verbal directions and time allowances when teaching or conducting activities. In the particular group of children studied by Thompson, "only a rare child was capable of judging comparative size" (Thompson, 1963, p. 149). On this basis the author concluded that there is probably little point in working on this type of task with the mongoloid child until he is eight or nine years old.

While certain of her findings are in substantial agreement with earlier reports on mongoloid children, her conclusions are questionable and require verification.

The pertinence of Hebb's theory (1949) to the present research stems from three basic implications. The first concerns the importance attributed to making the most of impaired neurological structures. The second pertains to the role of attention and the necessity of control over irrelevant stimulation in the production of new learning. The third derives from Hebb's assertion that for maximum effectiveness intellectual training should begin early in the individual's development. In order to compensate for the defective integration level of the retardate, Benoit (1957) emphasized the importance of sequential progression by units appropriate to the individual in teaching new materials, and the value of reenforcement of a scanty set of perceptual structures. Through "guiding" perception with more explicitness the learning situation becomes better organized, and thus the characteristics of rigidity and stimulus-bound behavior can be more effectively counteracted. Since the level of integration rises slowly in mentally retarded individuals, special emphasis should be placed on the proper selection of materials and on sufficient time for adequate practice. These principles combine to control the learning situation -- a basic concept in educational procedures with mentally defective children proposed by educators from Seguin to Sarason.

The concept of learning set introduced by Harlow (1949) has stimulated much research with normal and retarded subjects in the area of learning. In primate research Harlow (1949) reported that when successive discrimination problems were presented to monkeys, each problem tended to be learned somewhat more readily than the preceding problem until, finally, the problems were learned in a minimum number of trials.

In a series of studies with mental retardates, Zeaman and his associates, as reported by Zeaman and House (1963), have extended Harlow's concept of learning set. In their early studies, these investigators reported that their data indicated that low-grade institutionalized retardates did not form learning sets on tasks similar to those used by Harlow. However, in later studies Zeaman and House (1963) concluded that learning sets were formed by such retardates, provided the problems were simple enough. These findings led to their proposal of a theory of attention which holds that retardates are not so much retarded in learning ability, per se, as they are in the ability to direct and maintain attention to the important features in the environment. This attention deficit is not attributed to any non-task-specific conditions such as motivation, emotion, memory, or understanding of the rules of the game, according to Zeaman and House (1963), but rather to their inability to attend to the relevant cues.

Methodologically, concept formation can be conceived as the process by which common responses to dissimilar objects or events are strengthened, as well as the process by which responses which are already in the behavior repertoire of the individual are performed. Two differentiated stages are noted in this description, abstraction and generalization. Abstraction signifies the linking of one sensory experience to another so that some details are omitted and others become dominant. Generalization signifies that the dominant detail or set of details, resulting from abstraction, is used as the basis for responding similarly to separate objects linked by abstraction, and for responding to other objects similarly linked. Rosenberg (1963) noted that experimental studies of the concept formation process following this definition are virtually nonexistent in the area of mental deficiency.

One study which did approach concept formation from this view was conducted by Bensberg (1958) when he investigated the influence of pretraining under three conditions on subsequent learning tasks with adolescent and young mental defectives. Bensberg (1958) concluded that pretraining which involved the appropriate set facilitated subsequent learning. These findings support the utility of the attention-set concept discussed above.

METHODOLOGY AND PROCEDURE

The present research was concerned with the acquisition of the size concept of "biggest" by noninstitutionalized preschool mongoloid children. The subjects were selected on the basis of low initial scores on a Size Concept Test designed for this study. A special program of training in this concept was arranged in which the complex task of identifying the biggest of three stimuli had been simplified. One group of children was trained with this program, another group served as a control. The effectiveness of this approach in aiding young mongoloid children to learn this concept was evaluated by testing their ability to transfer this training to tasks similar to the training tasks, as well as their ability to utilize this concept on more complex tasks. The subjects in the experimental and control groups were individually matched in their initial performance on the Size Concept Test, as well as certain personal variables to be discussed later.

SUBJECTS

The subjects for this study were selected from various educational centers in the New York City area where classes are conducted for retarded children who live with their families. One hundred mongoloid children were screened for participation in the project on the basis of their total scores on the initial administration of the the Size Concept Test, which was constructed for this study. In order to avoid the inclusion of children with serious visual or auditory defects, each child's medical record was examined. Only 16 of the 100 children initially tested were excluded because their scores fell above the pre-established cut-off score on the Size Concept Test and thus gave evidence of having already acquired the concept of "biggest." Twenty-four children who met the test-score criterion were excluded for a variety of other reasons, e.g., change of residence, parental objection to participation, physical illness, translocation-type mongolism.

The remaining 60 subjects were assigned to the experimental and control groups through individual matching for chronological age, mental age, school experience, parental social class position, and scores on the Size Concept Test. There were 31 boys and 29 girls in the entire sample of subjects. The experimental group consisted of 15 boys and 15 girls, the control group contained 16 boys and 14 girls.

In Table 1 the range, mean, and standard deviation of each group on chronological age and mental age have been reported. The chronological age in months was calculated at the exact time of participation in the study. In the experimental group ages ranged

TABLE 1

RANGE, MEAN, AND STANDARD DEVIATION OF EXPERIMENTAL AND CONTROL SUBJECTS FOR CHRONOLOGICAL AGE AND MENTAL AGE EXPRESSED IN MONTHS

Group	N	Chronological Age			Mental Age		
		Range	M	SD	Range	M	SD
Experimental	30	40-96	74.43	11.84	20-41	29.3	6.35
Control	30	46-97	74.13	13.05	19-41	30.5	5.88

from 40 months to 96 months with a mean of 74.43 months, while in the control group ages ranged from 46 months to 97 months with a mean of 74.13 months. In terms of years, the experimental group ranged from 3 years-4 months to 8 years, with a mean of 6 years-2 months; the control group ranged from 3 years to 8 years-1 month, with a mean of 6 years-2 months. Each child's mental age was derived from the Kuhlmann Tests of Mental Development (Kuhlmann, 1939) or the Revised Stanford-Binet Intelligence Scale, Form L-M (Terman & Merrill, 1960). The investigator administered all of the Kuhlmann Tests and the Stanford-Binet Scales except for three children whose mental ages were taken from their records. Mental ages ranged from 20 months to 41 months with a mean of 29.3 for the experimental group, and from 19 months to 41 months with a mean of 30.5 in the control group. In terms of years, the experimental group ranged from 1 year-8 months to 3 years-5 months, with a mean of 2 years-5 months; the control group ranged from 1 year-7 months to 3 years-5 months, with a mean of 2 years-6 months. The intelligence quotients of the experimental group ranged from 27 to 52, with a mean of 36.3; in the control group they ranged from 24 to 53, with a mean of 38.1.

The school experience of all subjects was calculated in terms of the number of months each child was enrolled in a school program. The mean number of months for the experimental group was 7.3, while the mean of the control group was 6.8.

Social class position was identified in terms of Hollingshead's Two Factor Index of Social Position (Hollingshead, 1957), in which occupation and years of education of the head of the household are combined to yield a single index. This index was then transposed into one of five social classes (See Appendix A). In Table 2 the number of children in each group whose family was assigned to each category of social class is reported. A large proportion of the subjects fall in the two lower

TABLE 2

PARENTAL SOCIAL CLASS STATUS OF EXPERIMENTAL AND CONTROL SUBJECTS

Categories of Social Class	Number of Subjects Experimental	Control
I	3	2
II	1	1
III	1	6
IV	21	15
V	4	6

classes. All of the subjects came from English-speaking homes. There were fourteen Negro children included in the study, seven in each group.

A blood sample from each child was obtained with the finger-prick technique by a trained laboratory technician in a hospital research laboratory. The chromosomal count for ten blood cells was sent to the investigator.[1] This cytogenetic report revealed that each subject selected for the study was a "regular trisomic mongoloid," with 47 chromosomes in each of the ten cells analyzed. Two children who did not meet this criterion were excluded from the study. A sample copy of the cytogenetic report appears in Appendix B.

Materials

The Size Concept Test consists of 25 items in five series of five items each. The series have been arranged in order of increasing difficulty. Within each series, however, all items are of the same difficulty level. Black outline figures drawn on 10x15-inch white cards are the stimuli in the two pictorial series, Series A and B. Three-dimensional objects mounted on 10x5-inch boards are used as the stimuli in Series C and D. In the last series a combination of pictorial and three-dimensional materials

[1]The chromosomal analyses were done by Philip Chang, M.A., who was then Research Associate at St. Vincent's Hospital and Medical Center in New York City.

has been arranged. For each test item three stimuli are presented, only one of which is classified as the correct response -- the "biggest" one of the three stimuli. Since the stimuli in each item consist of the same picture or three-dimensional object in three sizes, six arrangements of the stimuli are possible. In order to avoid position or pattern sets, each item was assigned at random to one of the six pattern arrangements.

The following explanation was given to introduce the test:

> We are going to play a game. Listen carefully to what I say. On each card you show me the biggest picture. When you find the biggest one you will get a candy in this jar. If you don't find the biggest one, you will not get a candy. Ready...here's the first one.... Show me the biggest one. Put your finger on the biggest __________(name of object or picture).

The last two sentences were the directions for each test item in Series A, B, C, and D. One M&M candy was given as the reward for each correct response.

Series A. The five items in this series are outline pictures of the following familiar objects: cats, tables, caps, cars, and girls. On each card there are three pictures of the object, e.g., Card 1 contains three cats identical in all respects except size.

Series B. These five items are outlines of geometric forms: rectangles, ovals, triangles, stars, and diamonds.

Series C. These five items are three-dimensional familiar objects: spoons, shoes, cake pans, trees, and lemons.

Series D. These five items are three-dimensional geometric forms: square, circular, triangular, and rectangular solids, and pyramids.

Series E. In this series a correct response requires the selection of the picture or object that corresponds with the directions given with each item. The correct response is always the biggest picture or object.

The items and directions for this series are as follows:

Item 1. A jar and three caps of different sizes.

Directions: "Which cap fits this jar?"

Item 2. A white card with a blue outline of a square, and three squares of blue paper varying in size.

Directions: "Which of these is just like this one?"

Item 3. A nest of three cubes and three additional cubes of varying size, one of which correctly completes the nest sequence.

Directions: "Watch...this one goes in here, and these go in here. (The examiner performs the activity.) Which one will they fit into next?"

Item 4. A standing paper doll, and three cutout coats, identical in color and style, but in three sizes.

Directions: "Which coat fits the dolly?"

Item 5. A string of large beads, and three separate beads of different sizes.

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Scores on this test are the total number of correct responses which a child makes to the test items. The first picture or object which a child selected was recorded as his response, unless he spontaneously changed his response, or corrected an error. The size of the object or picture selected was recorded by the investigator on a separate record sheet (See Appendix C). The number of correct responses on each subtest series was also tabulated. Since there are 25 items in the test, the minimum score significantly better than chance at the .01 level is 15. Therefore 14 was used as the cut off score for inclusion of subjects in the study.

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The training materials consisted of 10x15-inch cards arranged in four sets of 14 cards each. On each card black outline pictures were drawn as stimuli.

Set 1. Black outlines of familiar objects. In selecting pictures for these training sets the pictorial materials used in standard intelligence tests were surveyed. It was decided that pictures similar to, but not identical with, those used at the lower levels of the Kuhlmann Tests and the Stanford-Binet Forms L and M would be appropriate. Suitable pictures were also chosen from readiness books and workbooks used in nursery schools and pre-primary classes. These were projected and enlarged for use in this study. Set 1 includes pictures of the following objects: ball, man, cup, tree, boat, horse, chair, dog, bird, key, airplane, apple, shoe, and teddy-bear. Each card has one picture on it. The response to be learned by the subject is the action of pointing to the object, or placing his finger on it. The instructions for this set are: "Put your finger on this. Put your finger on the ________ (name of the object in picture)." When a subject responded correctly, he was rewarded verbally and with an M&M candy, before he proceeded to the next card. If a subject did not respond correctly, the examiner encouraged him to imitate her action by putting her finger on the picture and by saying: "You put your finger on too."

Set 2. On each card in this set there are two pictures, a large and small picture of the same objects used in Set 1. The position of each size was randomly assigned throughout the set to avoid position responses. The directions for this set and for the two subsequent sets are: "Show me the big one (biggest one). Put your finger on the big (biggest) ________ (name of object in the picture)." Each correct response was rewarded verbally and with candy before the subject proceeded to the next card. When a subject did not select the biggest picture his response was corrected by the examiner in the following manner. "No, that is not the big (biggest) one. This is the big (biggest) one. You put your finger on the big (biggest) ________ (name of picture)." While saying this the examiner pointed to the correct picture and encouraged the subject to do likewise.

Set 3. In this set the same pictures of objects in two sizes used in Set 2 are presented with a third picture introduced on each card. This third picture is one of the small pictures of objects used on another card.

Set 4. In this set three pictures of the same object are presented on each card, a large, intermediate, and small outline picture of the same objects used in the earlier sets.

The subject continued learning each set until he correctly responded to 10 out of 14 consecutive items, i.e., any 10 items correct in a single trial. The number of trials and the number of correct responses were recorded.

In order to control for reward expectancy, subject-examiner relationship, and practice in the pointing response, the control subjects spent an equivalent amount of time with the examiner during which the subject engaged in picture selection tasks. These utilized six 10x15-inch white cards, on each of which nine small black and white pictures of familiar objects were arranged. The pictures were selected from preschool picture books, cut and mounted on the cards in three rows of three pictures, as follows.

Card 1: duck, rocket, egg, orange, bus, store-front, glove, nail, and rabbit.

Card 2: dress, TV set, jack-in-the-box, fish, train, bow, hat, bear, and window.

Card 3: bird, dog, giraffes, sun, crayon, bus, saw, house, and eggs.

Card 4: cat, foot, leaf, clock, cupcake, sweater, key, tree, and butterfly.

Card 5: saw, crayon, window, money, key, yoyo, apron, monkey, and sink.

Card 6: truck, fork, candles, bed, doll, pail, dog, plate, and cup.

The directions were: "Show me the ________ (name of object). Put your finger on the ________." Each child was encouraged to put his finger on a picture each time, but only correct responses were rewarded verbally and with an M&M candy. Incorrect responses were neither rewarded nor corrected.

The entire set of six cards was presented to each control subject in the sequence indicated above, i.e., Cards 1, 2, 3, 4, 5, and 6. The number of presentations varied from subject to subject. The time each control subject spent on the picture selection tasks was determined by the time that had been required for criterion learning by his matched mate in the experimental group.

Procedure

The Size Concept Test was given to each subject in order to determine his eligibility for participation in the study. Since the design of the study rested on the selection of children who had not acquired the size concept of "biggest," only children who earned a total score of 14 or below were considered eligible. The mean score of the entire group of 60 children was 10.56 and the range was 4 to 14. The close matching of individual pairs of subjects was reflected in the mean of 10.7 for the control group and 10.43 for the experimental group.

The children were then matched for chronological age, mental age, parental social class position, educational experience, and total score on the Size Concept Test. These data for each child were entered on index cards and from each pair one subject's card was randomly selected by a colleague who was not involved in the project. By this arrangement, 30 subjects were selected and assigned to the experimental group, while their matched mates comprised the control group. The following experimental design was followed:

Experimental Group	Control Group
Pretest with Size Concept Test	Pretest with Size Concept Test
Training Program	Picture selection tasks
Posttest with Size Concept Test	Posttest with Size Concept Test

All testing and training sessions were conducted in the building where each child attended class, or where he was seen for preadmission evaluation. Each child was seen individually for all sessions by the investigator. Within one week after pretesting, each experimental subject was seen individually for training on consecutive days. All subjects began training on Set 1 of the training program. When the criterion of 10 correct responses was attained, the subject proceeded to the next set. The same criterion of 10 correct responses was maintained for the four training sets. Individual sessions varied in length of time from 12 to 20 minutes, depending on each child's motivation, interest, fatigue, etc. Sixteen subjects completed the entire training program in one session. The remaining

14 subjects were trained in two sessions. The mean time of the group was 23 minutes with a standard deviation of 6.9; the range for the individual cases was from 15 to 40 minutes. The posttest of the Size Concept Test was administered in a separate session on the day following the last training or picture-selection session for experimental and control subjects, respectively.

RESULTS

Reliability of Size Concept Test

In preliminary testing with normal subjects an odd-even reliability coefficient of .97 was obtained. From the pretest scores of the mongoloid subjects, reliability coefficients of .25 and -.08 were obtained in the experimental and control groups, respectively. These statistically insignificant coefficients indicate that the subjects were presumably guessing on the pretest. The coefficients computed on posttest scores for the experimental group, .68, was significant at the .01 level, and that of the control group, .40, was significant at the .05 level. The critical ratio of the difference between these coefficients, 1.51, indicates that this difference was not statistically significant, but was in the anticipated direction.

Performance in Training

The number of trials required by the experimental subjects for criterion learning on the four sets of the training program are summarized in Table 3. It will be recalled that the criterion of learning was 10 out of 14 correct responses. Each trial consisted of the presentation of 14 items, each item on a separate card. In terms of cards, therefore, one trial includes 14 card presentations, two trials includes 28 card presentations, and so forth.

TABLE 3

DISTRIBUTION OF EXPERIMENTAL SUBJECTS IN NUMBER OF TRIALS REQUIRED FOR CRITERION LEARNING IN THE TRAINING PROGRAM

Number of Trials	Set 1	Set 2	Set 3	Set 4
1	26	9	2	13
2	4	8	10	6
3		6	12	8
4		2	3	3
5		4	3	
6		0		
7		0		
8		0		
9		1		
Range	1-2	1-9	1-5	1-4
Mean	1.13	2.67	2.83	2.03
SD	.35	1.77	1.04	1.05

On Set 1, which required no size discrimination but only attention and the motor response of pointing, criterion performance was reached with the fewest number of trials. On Sets 2, 3, and 4, in which size discrimination and the concept of "biggest" were required, more trials were necessary. Since the same sequence of set presentation was used with all subjects, however, the relative difficulty level of each set cannot be evaluated from these data. It would appear that the repetition and reenforcement of learning the earlier sets had positive transfer effects on the learning of Set 4. A priori this set was judged to be the most difficult of the four, but it will be noted that it required next to the lowest number of trials.

Posttest Performance of Experimental and Control Groups

In the control group posttest scores ranged from 9 to 19, with a mean of 13.73; in the experimental group the scores ranged from 16 to 25, with a mean of 21.03. The correlation between the posttest scores of matched experimental and control subjects was .398, which is significant at the .05 level. This correlation is substantially lower than the corresponding correlation of .819 which was obtained on the pretest scores. The pairs of subjects who were so closely matched on pretest scores are notably different on posttest scores, following the different training experiences to which experimental and control subjects were exposed.

Pretest-Posttest Gains in Experimental and Control Groups

In order to evaluate the changes in test scores in both groups of subjects, the score distributions and differences between pretest and posttest scores for each pair of subjects were compared. These data are presented in Table 4. It will be noted that for all the subjects in the experimental group these changes in scores indicate gains from pretest to posttest, the gains ranging from 5 to 18 points. In the control group, three subjects showed no change in scores and four subjects earned posttest scores which were lower than their pretest scores. The score changes in the control group ranged from a loss of 4 points to a gain of 10 points. The mean gain was 10.60 in the experimental group, and 3.03 in the control group.

The differences between the gains for the matched pairs of subjects in the experimental and control groups are given in the fourth column of Table 4. These differences represent the net gains attributable to the training program. When the mean gain of 7.57 is evaluated in terms of its standard error of .588, it yields a *t* ratio of 12.87. The net gain is thus highly significant and indicates that those subjects who received training made significantly higher gains than those who did not receive training. Thus the first hypothesis of this study was confirmed.

It can be seen in Table 4 that both groups earned significantly

TABLE 4

DISTRIBUTION OF GAINS IN SIZE CONCEPT TEST FOR PAIRED EXPERIMENTAL AND CONTROL SUBJECTS

Subj. Pair	Gain Exp.	Gain Cont.	Net Exp. Gain (Exp.-Cont.)	Subj. Pair	Gain Exp.	Gain Cont.	Net Exp. Gain (Exp.-Cont.)
1	8	0	8	17	14	10	4
2	7	-2	9	18	7	1	6
3	10	4	6	19	18	4	14
4	13	5	8	20	17	6	11
5	8	-1	9	21	12	2	10
6	11	1	10	22	8	2	6
7	6	3	3	23	12	2	10
8	8	4	4	24	13	7	6
9	8	-3	11	25	5	-4	9
10	5	4	1	26	8	7	1
11	10	5	5	27	13	4	9
12	16	5	11	28	8	3	5
13	12	0	12	29	11	2	9
14	18	7	11	30	13	7	6
15	11	6	5	Mean	10.60	3.03	7.57
16	8	0	8	SD			3.17
				SE_M			5.88
				t			12.87**

**P < .01

higher posttest scores. Although gaining significantly less than the experimental subjects, the controls as a group did show significant improvement from pretest to posttest. The *t* ratios are 5.11 in the control group, and 16.10 in the experimental group. Both are significant well beyond the .01 level.

Sex differences. Since 29 girls and 31 boys comprised the group of subjects, it was considered of interest to investigate sex differences in gains, that is, gains from pretest to posttest. The distribution of gains for the boys and girls in each group are presented in Table 5. In the experimental group, the boys' gains

TABLE 5

GAINS BY BOYS AND GIRLS IN EXPERIMENTAL AND CONTROL GROUPS

Gains	Experimental		Control	
	Boys	Girls	Boys	Girls
16 - 19	1	3		
12 - 15	4	4		
8 - 11	6	7	1	
4 - 7	4	1	7	7
0 - 3			6	5
-4 - -1			2	2
Mean	9.87	11.33	3.24	2.79
SD	3.55	3.47	3.35	3.27
t	1.10		.359	

ranged from 5 to 18 points, with a mean of 9.87; the girls' gains ranged from 7 to 18 points, with a mean of 11.33. The mean difference of 1.46 points in favor of the girls has a standard error of 1.33 and a *t* ratio of 1.10; hence it is not significant. In the control group, the boys' score changes from pretest to posttest ranged from -4 to +10 points, with a mean of 3.24, while for the girls they ranged from -3 to +7, with a mean of 2.79. The mean difference, .45, in favor of the boys, is not significant. It is also noteworthy that the sex difference was in the opposite direction in experimental and control groups.

Chronological and mental age. It will be recalled that the subjects in the experimental group ranged in chronological age from 3 years-4 months to 8 years, with a mean of 6 years-2 months. In the control group, ages ranged from 3 years to 8 years-1 month, with a mean of 6 years-2 months. The relationship between chronological age and gains in total scores from pretest to posttest was investigated by means of correlation coefficients. The obtained coefficients of .248 and .261 in the experimental and control groups, respectively, are both statistically insignificant.

In order to investigate the relationship between mental age and gains in scores, further coefficients were computed. Mental ages of the experimental subjects ranged from 1 year-8 months to

3 years-5 months, with a mean of 2 years-5 months. In the control group, they ranged from 1 year-7 months to 3 years-5 months, with a mean of 2 years-6 months. The correlation coefficient between gains and mental age for the experimental group was .122, while that for the control group was .006. Neither of these coefficients attains significance. On the basis of these low correlations it would appear that the improvement demonstrated by these subjects was not significantly related to maturational or intellectual level within the ranged covered.

Transfer of Training

In order to evaluate the extent to which experimental subjects manifested transfer effects and generalization of the concept of "biggest," their subtest scores on each of the five series of the Size Concept Test were examined (Series A to E). The subtest scores on pretests and posttests are presented in Table 6. It had been hypothesized that the experimental subjects would demonstrate positive transfer effects by gains on the subtests involving materials and tasks which were more complex than the training tasks. The gains reported in Table 6 clearly confirm this hypothesis, insofar as sizeable gains occurred in all five series.

The pattern of gains which emerged followed the expected trend. The five subtests of the Size Concept Test had been arranged in

TABLE 6

TOTAL NUMBER OF CORRECT RESPONSES AND GAINS ON FIVE SERIES OF THE SIZE CONCEPT TEST FOR EXPERIMENTAL AND CONTROL SUBJECTS

Series	Experimental			Control		
	Pretest	Posttest	Gain	Pretest	Posttest	Gain
A	72	141	69	86	101	15
B	64	148	74	65	79	14
C	62	121	59	61	83	22
D	66	134	68	54	82	28
E	49	104	55	53	69	16

order of increasing complexity and in decreasing similarity to the training tasks. Thus the tests ranged from simple size discrimination of familiar objects in pictorial form in Series A, to more complex matching tasks with pictorial materials and three-dimensional objects in Series E. It will be recalled that the training program consisted entirely of pictorial materials. It was therefore expected that the gains in posttest scores would be greatest in Series A and B, and least in Series E. As expected, the experimental subjects did show their highest gains in Series A and B, and their least gains in Series E. The gains on Series C and D, although intermediate, are less clear cut. In the control group, no such regular pattern of gains emerged. In Table 6 it can be seen that smallest gains occurred in Series A, B, and

E, and the largest gains in Series C and D. The intervening experiences of the control group with pictorial materials on the picture selection tasks were equally relevant to all parts of the Size Concept Test.

The differences between the gains made by the experimental and control groups are reported in Table 7. As would be expected, the

TABLE 7

DIFFERENCES IN GAIN BY EXPERIMENTAL AND CONTROL GROUPS ON EACH SERIES OF THE SIZE CONCEPT TEST

Series	Gain		Difference in Gain
	Experimental	Control	(Exp. -Cont.)
A	69	15	54
B	74	14	60
C	59	22	37
D	68	28	40
E	55	16	39

experimental group, as a whole, gained more than the control group on all subtests. The greatest differences in gains, however, occurred in Series A and B, with smaller differences in the gains in Series C, D, and E. This finding is understandable in view of the fact that the training undergone by the experimental subjects was most similar to the tasks in Series A and B of the Size Concept Test.

CONCLUSIONS AND IMPLICATIONS

On the basis of the findings of this research, the following conclusions are suggested. First, sequential individual training in size discrimination tasks is effective in teaching size concepts to young trisomic mongoloid children. Second, after receiving training on simplified tasks, mongoloid children demonstrate positive transfer effects on more complex tasks. Third, pictorial materials are effective as tools for teaching young mongoloid children simple concepts which they can then apply to three-dimensional objects.

In the standardization group for the Revised Stanford-Binet Intelligence Scale, Form L-M (Terman & Merrill, 1960), approximately 80 per cent of the normal children gave evidence of the ability to discriminate the bigger of two balls at a mental age of 3 years-6 months. The mean mental age of the mongoloid children in this study was 2 years-6 months. The discrimination of the biggest of th objects is at least as difficult as the discrimination of the bigger of two objects, or more difficult. The results obtained here suggest that, with sufficient planned training, young mongoloid children are capable of learning this basic concept of "biggest," which normal children of a higher mental age acquire incidentally.

The deficit in discrimination learning reported in older mongoloids may be due to the fact that older mongoloids have already learned habits which interfere with discrimination learning. The consistent progress in the training program shown by the subjects in this study indicates that these young subjects may not have had the opportunity to acquire fixated responses which would interfere seriously with learning. The fact that noninstitutionalized preschool mongoloid children were used may have been one reason for the positive results obtained.

With regard to sex differences, the insignificant differences in gains reported here are in substantial agreement with the majority of reports by other investigators with mongoloid children on discrimination learning tasks. It is interesting to note, however, that the girls in the experimental group tended to gain more than the boys. Although this difference in favor of the girls was statistically insignificant, it was in the same direction as that found by Martin and Blum (1961). In their study of discrimination learning the mongoloid girls earned somewhat higher scores than the mongoloid boys.

The low correlation coefficients obtained between chronological age and pretest-posttest gains indicate that success on this type of task is not related to age within the range studied. This finding is offered as evidence of the suitability of training programs of the type used in this study for mongoloid children over a considerable age span. It would also suggest that mongoloid children could profit from structured training at an earlier age than that at which such training is usually introduced. With regard to mental age, there appears to be no relation between gains and mental age in this group of subjects. The extreme restriction in range of mental ages in the present groups may account for such lack of correlation.

The tasks and materials designed for this study proved to be highly satisfactory for use with young mongoloid children. The test items were attractive and appealing to the children. Since the entire test could be administered in 15 minutes, the children's interest and motivation could be sustained. The M&M candies were effective as rewards in both the training and testing sessions.

The performance in training by the experimental subjects supports the conclusion of Zeaman and House (1963) that low-grade retarded children are capable of forming learning sets provided the problems to be learned are simple. In the training program criterion performance was reached with the fewest number of trials on Set 1. The number of trials ranged from one to two. This set had been judged as the easiest of the four sets with regard to stimulus and response. There was only one large picture on each card, and the subject was required merely to point to the picture. No size discrimination was required on this set. On Set 2 the child had to learn to select the biggest one of two pictures. The number of trials required on this set ranged from one to nine. On the cards in Set 3, a third object had been introduced as "noise in the channel." This third object did serve as a distractor, in that many children named this object on the first trial with this set. By the second trial they had learned to respond to the object named by the examiner. The repetition of the same objects throughout all of the sets appears to have facilitated learning on Set 4.

The decrease in the number of trials required for criterion learning on the last set in the training program and the increase in the number of correct responses on the first trial of this set support Zeaman's "attention-set" theory. This theory states that the learning disability of retardates is attributable to their inability to direct and maintain attention to the relevant dimensions of the problem stimuli. Where irrelevant dimensions are eliminated in the tasks, as in the present study, the subjects appear to be capable of forming learning sets on size discrimination tasks.

Although conclusive evidence is lacking, several investigators have stated that retarded children can form and utilize concepts only on items with which they have been trained. The findings in the present study are offered as evidence of the fact that after training on one type of material, namely, simple pictorial tasks, young mongoloid children are able to utilize the concept of "biggest one" on other types of materials. Zeaman and House (1963) reported that the ability to transfer such learning appeared to be enhanced by success on an initial simple task. In their study, those subjects who practised on easy tasks learned discrimination tasks more rapidly when presented with a difficult pattern discrimination task than did those subjects who practised on difficult discrimination tasks only.

The results in the present study supply similar evidence. In the training program, the subjects experienced easy success in few trials on Set 1. The task involved the simple motor response of pointing to the pictured object. Then the child progressed to the more difficult tasks of learning which was the biggest of two, and then, three pictured objects. The immediate knowledge of results and the correction of errors also facilitated learning.

The hypothesized transfer effects were noted in the posttest scores of the experimental subjects. Their highest number of correct responses and their greatest gains were on those tests which were most similar to the training tasks - Series A and B. However, they also improved to a similar degree on the subtest in which three-dimensional geometric forms were the stimuli, Series D. This unexpected result may be due in part to the common property shared by Series A, B, and D--the absence of color. The materials used as stimuli in Series C and E were colored objects and pictures. This suggests that color may have contributed to the difficulty level of these test items, by distracting the children from the size discrimination task.

The relatively large gains on Series B and D, as compared with the gains in Series A, were contrary to expectations. This finding suggests that geometric forms may have been easier for the children to discriminate than were the pictures of real objects used in Series A. The meaningful association to real objects may have distracted the children from the size discrimination task. This would have added to the difficulty level of Series A, and would therefore give advantage to the geometric forms used in Series B and D. Thus, it would seem that color and meaningful associations both served as distractors with these subjects and interfered with the size discrimination tasks. Martin and Blum (1961) reported a similar finding with mongoloid children. Their subjects were less able to discriminate size properties when the objects presented varied in color and form.

An unexpected finding was the significant gain of the control group. These gains in posttest scores suggest that the experiences which these subjects underwent did increase their ability to respond on the posttest administration of the Size Concept Test. Experiences such as taking the pretest, locating and responding to one picture at a time, and working individually with the investigator for candy rewards apparently exercised a significant influence on these children. Certain factors, extraneous to the study, such as other school experiences and the mere passage of time, may have contributed to these results. But all of this did not effect a gain in scores equal to the gain of the experimental group. Therefore, the major effect can be attributed to the training which the experimental subjects received, independently of the other influences.

In terms of the major finding in this study, trained mongoloid children made gains from pretest to posttest which were significantly higher than the gains of the control subjects who did not receive the same training. The effectiveness of a special individualized training procedure with young mongoloid children on size discrimination tasks was clearly demonstrated.

In terms of the sample of subjects used in this study a major feature was the homogeneity of subjects with regard to the subtype of mongolism. The confirmation of trisomic mongolism by the chromosomal analysis of each subject's blood sample, presented conclusive evidence of this diagnosis. Since the vast majority of mongoloids belong to this subtype (Mauer, 1965), the findings in this study are considered applicable to a relatively large group of mongoloid children.

On the basis of these findings, the following suggestions for further research seem warranted. First, the replication of the present study with two experimenters, one to administer the tests and the other to train the children, would eliminate any possible effects of experimenter bias. Recent evidence of the effect of the examiner on the responses of subjects has been discussed by Rosenthal (1964). Zigler (1962) has suggested that this effect may be more influential on the responses of feebleminded subjects as a result of social deprivation. Thus it would seem desirable to rule out the role of the examiner and to determine how far improvement can be generalized to another examiner. However, with the simplicity and objectivity of procedure and objectivity of scoring used in the present study, such effects were considered minimal. In an initial, exploratory study with this type of approach, it was considered desirable to have one experimenter conduct all sessions with the subjects. The social responsivity of mongoloid children was a prime factor leading to this decision, since for such children, a change of examiners may be equivalent to a change in the test. Since the examiner is part of the test situation and the extent to which he influences mongoloid subjects' test behavior has not been investigated, it was thought to be important to use one person throughout the study.

Second, the retention of the effects of training could be studied by administering the Size Concept Test after a longer lapse of time. The immediate effectiveness of training was investigated in this study with a 24-hour interval between training and posttest sessions. It would be desirable to extend these findings by obtaining retent data over longer periods of time.

Third, the development of tests and training programs on other basic concepts of size, color, and form, based on the principles used here, would contribute further evidence as to the effectiveness of this type of training. Fourth, the training program in this study utilized pictorial materials only. A training program with three-dimensional objects would make it possible to explore the differential effects of these two types of materials with mongoloid children. It would also make it possible to explore more fully the extent of generalization of training effect.

Fifth, in the present research candy rewards were used as a reenforcement of correct responses, along with verbal reenforcement. Variations in type of reward with and without verbal reenforcement could be explored as to their effects on the learning ability of mongoloid children.

The educational value of these findings is related to the development of educational programs appropriate to the unique strengths and weaknesses of young mongoloid children. Through the extended application of the principles utilized in the present study it is hoped that retarded children can be taught basic concepts at a younger age than that now considered feasible, and thus be better trained for participation in vocational programs.

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APPENDIX A

DESCRIPTION OF METHOD USED IN DETERMINING PARENTAL SOCIAL CLASS

The method employed in determining parental social class position is the Two Factor Index of Social Position developed by Hollingshead (1957). This index is premised on three assumptions: (1) a status structure exists in the society; (2) positions in this structure are determined mainly by a few commonly accepted symbolic characteristics; and (3) the characteristics symbolic of status may be scaled and combined by the use of statistical procedures so that the population under study can be quickly, reliably, and meaningfully stratified.

The Scale Scores

To determine the social position of an individual or of a household two items are essential: (1) the precise occupational role the head of the household performs in the economy; and (2) the amount of formal schooling he has received. Each of these factors are then scaled according to the following system of scores.

A. The Occupational Scale

1. Higher executives, proprietors of large concerns, and major professionals.
2. Business managers, proprietors of medium sized businesses, and lesser professionals.
3. Administrative personnel, small independent businesses, and minor professionals.
4. Clerical and sales workers, technicians, and owners of little businesses.
5. Skilled manual employees.
6. Machine operators and semi-skilled employees.
7. Unskilled employees.

B. The Educational Scale

1. Graduate professional training.
2. Standard college or university graduation.
3. Partial college training.
4. High school graduates.
5. Partial high school.
6. Junior high school
7. Less than seven years of school.

Integration of the Two Factors

The factors of Occupation and Education are combined by weighting the individual scores obtained from the scale positions. The weights for each factor are:

Factor	Factor Weight
Occupation	7
Education	4

The scale score for each factor is multiplied by the factor weight for each and the total is the Index of Social Position Score.

Index of Social Position Scores

The Two Factor Index of Social Position Scores may be arranged on a continuum, or divided into groups of scores. The range of scores on a continuum is from 11 to 77, the higher the score, the lower the social status. These scores have been arranged into a hierarchy of score groups as follows:

Social Class	Range of Computed Scores
I	11-17
II	18-27
III	28-43
IV	44-60
V	61-77

APPENDIX B

SAMPLE COPY OF CYTOGENETIC REPORT

Cytogenetic Study Report.

Case #________ Name:________________________ Chart #________

Phenotypic Sex____________________ Nuclear Sex________________

Born______________ Race____________

Reference (Reason for Study):

Parental Conceptional History: (Box indicates propositus).

Sib. #__________ Deaths____________

Sex____________

Maternal Age__________

Paternal Age__________

Clinical Data:

Measurements:

Chromosome Counts:

Biopsy	<44	44	45	46	47	48	>48	Total

Sex Chromosome Complement:

Chromosomal Abnormalities:

Remarks:

APPENDIX C

SCORE SHEET FOR SIZE CONCEPT TEST

Score Sheet for Size Concept Test

Subject ______________________________ PRE-TEST

Score ______________________________ POST-TEST

Series A. ______

1.	cats	B	M	S
2.	tables	B	S	M
3.	caps	S	M	B
4.	cars	M	S	B
5.	girls	S	B	M

Series B. ______

6.	rect.	M	S	B
7.	ovals	B	S	M
8.	triang.	S	M	B
9.	stars	S	B	M
10.	diam.	B	M	S

Series C. ______

11.	spoons	M	B	S
12.	shoes	B	S	M
13.	pans	B	S	M
14.	trees	M	S	B
15.	lemons	M	B	S

Series D. ______

16.	squares	B	M	S
17.	circles	S	B	M
18.	triangles	M	S	B
19.	rect. sol.	B	M	S
20.	pyramids	M	S	B

Series E. ______

21.	jar & caps	S	M	B
22.	blue. squ.	B	S	M
23.	nest of cub.	M	B	S
24.	doll & coats	S	B	M
25.	beads	S	M	B