ED 053 791 PS 004 754

AUTHOR Hooper, Frank H.
TITLE An Evaluation of Logical Operations Instruction in the Preschool.
PUB DATE 22 May 70
NOTE 63p.; Paper prepared for a conference of the Center for Advanced Study in Education, City University of New York, New York, May 22-24, 1970

EDRS PRICE EDRS Price MF-$0.65 HC-$3.29
DESCRIPTORS Age Differences, *Cognitive Development, Educational Programs, Group Activities, *Literature Reviews, *Maturation, *Preschool Children, *Preschool Curriculum
IDENTIFIERS Piaget, Shantz, Sigel

ABSTRACT

As a preparatory step to the design of a preschool curriculum, this study examines three of the complex cognitive behaviors exemplified by the concrete operations period and its developmental prerequisites. Middle-class children in a university laboratory nursery setting were pretested, matched for age and randomly assigned to an instruction or a comparison control group. The instruction group was trained in two clusters of four children per teacher on labeling-classification, discrimination-memory, and seriation tasks. Each cluster consisted of a younger boy, a younger girl, an older boy and an older girl. Each session consisted of 20-30 minutes of organized activity and there were 12 sessions over a 3-week period for each training condition. The control group children had an equivalent amount of separate small group activity with a preschool teacher. The results of posttesting and transfer tasks support the contention that the developmental status of the curriculum target population will determine to a great extent the success or failure of an educational intervention effort. Age-related maturational components are important considerations in any curriculum attempt to modify the course of cognitive development. One half the document presents bibliography and appendixes detailing the training programs. (WY)

AN EVALUATION OF LOGICAL OPERATIONS INSTRUCTION IN THE PRESCHOOL[1]

Frank H. Hooper
Division of Family Resources
and Department of Psychology
now at
University of Wisconsin
~~West Virginia University~~
Madison, Wisconsin

The developmental acquisitions which mark the general preschool period of two to five years of age are acknowledged to be of impressive magnitude and importance within the life-span of the human organism. The essentially nonverbal, sensory-motor oriented infant becomes an individual who has acquired the rudiments of sociopsychological functioning in his cultural milieu. Linguistic functioning shifts from the gesture-vocable level of the shared concrete context to the active production, manipulation, and comprehension of the language medium which approximates the mature adult model (Langer, 1969; Werner and Kaplan, 1963). Perhaps most importantly, this age interval is highlighted by the emergence of imitative schemas which are the genetic precursors of representational and operative thought of the concrete operational period. The focal questions remain; what is the potential role for the preschool setting as an active agent in the developmental change process, and what curriculum orientation offers the best opportunity for optimizing the positive cognitive and socioemotional advances associated with the early childhood period?

The status of experiential factors represented by preschool instruction as significant influences upon developmental processes is still an open issue. The recent evaluations of Head Start programs (Cicerelli et al.,

[1] Prepared for a conference: "Conceptualizations of Preschool Curricula." Center for Advanced Study in Education, City University of New York, May 22-24, 1970.

1969; Cicerelli, Evans and Schiller, 1970; Smith and Bissell, 1970) and the controversy over the relative contributions of genetic vs. experiential factors in cognitive acceleration (Albee et al., 1969; Jensen, 1969_A, 1969_B; Vernon, 1970; and Harvard Educational Review, 1969, Nos. 2 and 3) attest to this. More specifically to present considerations, Elkind (1970) has evaluated the merits of the academically-centered preschool and stated that the economics, efficiency, and critical learning period aspects of preschool instruction are of questionable positive value insofar as the middle-class child is concerned. While the case of preschool enrichment for the disadvantaged child is not as clear-cut, Elkind concluded:

> There is no preponderance of evidence that formal instruction is more efficient, more economical, more necessary or more cognitively stimulating than the traditional preschool program. Indeed, while there is room for improvement in the traditional preschool, it already embodies some of the most innovative educational practices extant today. It would, in fact, be foolish to pattern the vastly expanded preschool programs planned for the future upon an instructional format that is rapidly being given up at higher educational levels. Indeed, it is becoming more and more apparent that formal instructional programs are as inappropriate at the primary and secondary levels of education as they are at the preschool level. Elkind (1970, page 139)

Regardless of the general merits of preschool instruction, it is certainly true that a large number of programs have been proposed and demonstrated which differ markedly in orientation, content, instructional strategy, and demonstrated effectiveness (Hooper and Marshall, 1968; Parker et al., 1970).

It is the contention of the present paper that the organismic-developmental viewpoint exemplified by the theoretical systems of Heinz Werner and Jean Piaget offer a fundamentally superior orientation to the design of an effective preschool curriculum. The relevance of Piaget's theory to educational application has been the theme of a number of contemporary writers, e. g.; Aebli (1951), Athey and Rubadau (1970),

Beard (1969), Brearly and Hitchfield (1969), Bruner (1960), Furth (1970), Ginsberg and Opper (1969), Hooper (1968), Kamii and Radin (1967), Ripple and Rockcastle (1964), Sigel (1969), Sonquist and Kamii (1967), Stendler (1965), Wallace (1965). Kohlberg (1968) has contrasted the Piagetian orientation with other conceptions of developmental change as they relate to preschool enrichment. He views Piaget's constructive interactionism as intermediate between the conceptual polarities of maturational determinism and reinforcement contingency environmentalism. This "compromise" aspect of the organismic position emphasizes a clearly reciprocal relationship between the developmental status of the preschool child and the imposed curricula which constitute the event contingencies of the preschool setting. Assuming the validity of Piaget's system and associated developmental norms, there appear to be a substantial number of considerations concerning the developmental status, content-topic requirements, and instructional techniques which are germane to preschool education.

Initially, there is the general principle of utilizing a developmental acquisition sequence as a guide to "what" content or task situation represents the optimal curriculum subject focus and "when" this material may be most efficiently introduced (Hooper, 1968). This is particularly true of the organismic model of developmental change which explicitly recognizes the coequal status of environmental input and individual structural capacity as interacting to yield cognitive reorganization. This is the logical and systematic outcome of Piaget's assimilation-accommodation dyad, and underlies the fundamental dynamics of the equilibration model. Repeated encounters with the surrounding environment lead to structural changes in the organism, and presuppose a changing view of external reality relative to the individual's position in the ontogenetic sequence. Insofar as directed instruction is concerned, this orientation demands a very precise

alignment between the cognitive capacity of the individual child and the task requirements imposed upon him.

The clear importance assigned to optimal structure-input alignment was initially elaborated by Hunt (1961) in his "match-mismatch" proposal. It specifies that the ideal learning condition involves just the right amount of discrepancy between the established cognitive schemas and the introduced problem setting. A careful match presents an intrinsically motivating task situation which neither bores nor overwhelms the child. It follows from this view that the final arbitor of curriculum design is the individual child's developmental status, not a demand or behavioral objective integral to a content or instructional domain.

The intrinsic motivational properties of an optimal cognitive structure-environmental input matching lead to a number of curriculum design implications. It is certainly similar in general orientation to the "self-discovery" learning position and, by implication, subject to common assets and shortcomings. The superiority of self-directed exploratory learning over direct instruction is agreed upon by traditional nursery proponents and the Genevan researchers, e. g.; Elkind (1967), Kohlberg (1968), Piaget (1964). From this view, the child is the self-correcting monitor of his behavioral progress, and it is the child who determines what is relevant vis a vis his environmental surround. From this view, the ideal curriculum program is one which provides adequate stimulation of a sufficiently diverse and attractive nature, and which permits maximal individual exploration. The problems of cognitive overload or simple overstimulation is clearly not provided for, since any input beyond the immediate capacities of the individual child would be automatically screened and excluded. The issue of inappropriate or excessive stimulation in early infancy, especially that of an instrumentally noncontingent

or random nature, has recently been discussed by Watson (1966, 1967, 1970). It is probably true that children of any age should be provided with explicit feedback concerning the effectiveness or degree of accuracy of their responses within any learning sequence.

Another aspect of the motivational dynamics of the organismic viewpoint involves the potential role of peer-group interactions as an effective route to qualitative cognitive change. The greater portion of the equilibration-induced cognitive reorganization that is fundamental to intellectual growth requires an active exchange of viewpoints, a sharing of personal perspectives, and a distinctive emphasis upon adult-child and peer-group interactions. As Flavell makes clear:

> One of Piaget's firmest beliefs, repeated over and over in scores of publications ... is that thought becomes aware of itself, able to justify itself, and in general able to adhere to logical-social norms of non-contradiction, coherence, etc., and that all these things and more can emerge only from repeated interpersonal interactions (and especially those involving arguments and disagreements) in which the child is actually forced again and again to take cognizance of the role of the other. It is social interaction which gives the ultimate *coup de grâce* to childish egocentrism. Flavell (1963, pp. 156-157)

These considerations are certainly pertinent to the preschool age-range and offer an integrative theoretical basis for much of the social play generally encouraged and fostered in the nursery setting. Small group situations were the training formats selected for the instructional attempt reported later in this paper.

The timing and content considerations briefly outlined above follow from any consistent application of developmental theory and norms to an educational effort, but they become particularly explicit for a stage-dependent conception of human development. The utilization of a stage construct, as in Piaget's system, carries considerable theoretical and empirical relevance insofar as training and enrichment efforts are

concerned. Stemming directly from the major criteria of stage specification for the Piagetians (Beilin, 1969_A; Inhelder, 1962), Wohlwill (1963), has delineated two definite corollary conceptual features, the assumption of invariance and the prediction of correspondence or convergence in development for any and all behavioral patterns native to a particular stage or developmental period. This usage of the stage construct may be contrasted with the essentially nontheoretical descriptive or representational stage designations by such investigators as Bijou and Baer, the Kendlers, and Sheldon White, e. g.; Reese and Overton (1970). In the first instance, the hierarchial nature of stage-sequential behaviors generates a series of developmental prerequisites and conceptually related subsequent behaviors of greater formal functional complexity. This implies an implicit curriculum sequence, for if initial assessment indicates the child to be operating at stage A, and stage C responses are desired, then stage B processes, strategies, and adaptations are the obvious instructional focus. There is a clear-cut operational congruence here between the developmental stage proponents and the hierarchial learning models proposed by Gogné (1968) and experimentally demonstrated by Gelman (1969), Kingsley and Hall (1967) and Rothenberg and Orost (1969) among others.

In the second case, the within-stage correspondence postulate involves the implicative nature of stage-related behaviors which yield across-task generalization following enrichment experiences or training. In the present context, instructional experiences focused upon one behavioral domain should generalize or transfer to other classes of behavior which share the same theoretically based stage location. This is the essence of the distinction between specific task-transfer and nonspecific far transfer of the general learning to learn set variety, e. g.;;Brainerd and Allen (1970) and Goulet (1970). Not coincidentally, this is one of the primary

experimental requirements of valid operational learning for the Genevan oriented researchers, (Beilin, 1969_A; Beilin, 1969_B; Hooper, 1970; Inhelder and Sinclair-de-Zwart, 1969; and Laurendeau and Pinard, 1969), i. e., the induced acquisitions must transfer to logically related task situations. The current picture regarding this operational requirement is mixed, and whether a specific training study reveals near or far transfer to other response categories appears to be a joint function of the selected task situations, the developmental status or chronological age of the subjects, and the variety of training-enrichment procedures utilized.

To briefly recapitulate, the present acceptance of the organismic-developmental position makes certain demands upon any curriculum design endeavor. The focus upon the individual-environment interaction setting and the acknowledgement of the stage sequence postulate requires an accurate and specific pretraining assessment of the child to determine basal behavioral levels. This is an essential first step prior to actual implementation of the intervention strategies. Following this, and operating within the demonstrated normative developmental progression, a series of explicit operational objectives should be specified. These directly relevant behavioral objectives provide the "landmarks" of the teaching sequence and also constitute the most explicit test of the program's demonstrated effectiveness. In addition, the final arbiter of an individual child's program sequence and progress is the child himself. Thus, the child should be permitted to monitor and pace his own acquisition pattern throughout the curriculum program. This will generally require the provision of response feedback information concerning accuracy, appropriateness, etc., at each point in the curriculum hierarchy.

Hopefully the present contentions will become clear when applied to a specific behavioral domain. The general content area of the present study is the complex cognitive behaviors exemplified by the concrete operations period and its developmental prerequisites. Specifically, we are interested in the developmental interrelationships among classificatory, relationality, and conservation skills as they are mediated by the Piagetian logical "groupings". As a preparatory step to the design of a possible preschool curriculum, it seemed appropriate to examine the short-term experimental attempts to induce or elicit Piagetian logical operations functioning in young children.

The experimental literature relating to the manipulatory induction of conservation acquisition has reached considerable proportions; Brainerd and Allen (1970), Sigel and Hooper (1968). An evaluation of these studies pertains directly to the crucial issue of maturationally based vs. experientially derived determinants of cognitive development. The training intervention paradigm, ideally as an integral component of a longitudinal assessment program, offers the only valid experimental opportunity to disentangle the relative contributions of maturational limitations or constraints from the role of experiential variables as factors in human cognitive growth. Unfortunately for present considerations, the evidence from the large number of Piagetian training attempts is certainly not conclusive. Interpretations range from a complete acceptance of the feasibility and practicality of conservation training (Brainerd and Allen, 1970; Goulet, 1970) to an elaborate denial of the cogency and validity of the demonstrated learning as evidence for qualitative cognitive change (Beilin, 1969_A, 1969_B; Inhelder and Sinclair-de-Zwart, 1969; Piaget, 1964; Wohlwill and Flavell, 1969). Beilin (1969_A) is particularly clear in assigning a subordinate role to experiential factors in the development

of logical operations processes preferring to emphasize the genetic pre-programming inherent in Piaget's theoretical system.

The final evaluation of the logical operations training, notwithstanding, it appears appropriate to examine the existent literature for guidelines to viable preschool curriculum design. Judging by the criteria for valid cognitive learning specified by Piaget (1964), long term stability, increased operational and functional complexity, and demonstrated non-specific transfer across conceptually related task settings, there are a number of studies which merit our attention.

Adequate feedback as to the correctness of response appears to be a critical determinant of learning a complex cognitive task. This was shown to be true of a quasiconservation area concept task, Beilin (1966), and represents an integral aspect of most successful conservation training strategies. This is certainly true of those studies which have employed a hierarchial learning-set orientation or task-analysis approach to concept acquisition. Kingsley and Hall (1967) applied Gagne's learning set analysis to instruction in length and weight conservation. Significant training effects were found for a group of five and six year old children, and the experimental groups also indicated improved ability on a transfer task of substance conservation. Rothenberg and Orost (1969) taught kindergarten children the probable steps necessary for number conservation. The effects of training were retained on a 3 month delayed post-test and conservation ability was found to generalize to a discontinuous quantity transfer task.

In a study which examined the role of numeration and comparison of discrete units of liquid quantity, Bearison (1969) found the training experiences facilitated conservation of continuous quantity and transferred to the conservation of area, mass, number and length. The experimental

children (average age 5 years, 10 months) maintained their superiority over a 7 month interval and their conservation explanations were analogous to those elicited from a group of "natural" conservers. Gelman (1969) administered discrimination learning set training to a group of five year old children who were classified as nonconservers of length, number, mass, and liquid quantity. Posttests indicated near perfect specific (length and number), and approximately 60% nonspecific (mass and liquid quantity) transfer of training and these results were stable over a 2-3 week period.

In addition to these positive findings concerning the role of learning sets, it is apparent that language processes are closely related to logical operations functioning. While the Genevan proponents (Beilin and Kagan, 1969; Furth, 1969; Inhelder and Sinclair-de-Zwart, 1969; Sinclair-de-Zwart, 1969) argue that operativity develops relatively independently of language aquisition and specific linguistic instruction, Bruner et al. (1966) stress the facilatory aspects of language mechanisms in the general transition from perceptual-iconic to symbolic functioning. Gruen (1965) found a combination of verbal pretraining (relational terms) and cognitive conflict training to be effective in eliciting number conservation with some evidence of far transfer to length and substance conservation.

Beilin (1965) compared a number of conservation acceleration techniques and found verbal rule instruction to be significantly efficient for length and number conservation. Although the subjects (median age 5 years, 4 months) failed to show nonspecific transfer to a quasiconservation area task, this task has been found to be of significantly greater difficulty than conventional area conservation (Beilin, 1964, 1966, 1969_B). While Beilin (1969_B) interprets these results as a case of algorithmic or "model" learning and questions the conceptual nature of such acquisitions,

Smith (1968) found a significant improvement in weight conservation for both nonconservers and transitional subjects (first and second graders) using the verbal rule instruction approach.

Of greater relevancy to the present study are those enrichment-acceleration attempts which have a clear basis within Piagetian conceptions and theory. These include those investigations of the role of certain logical operations skills, i. e., reversibility, relationality, and classification, as they bear on conservation performance. Reversibility instruction significantly influenced number conservation (average age of children, 6 years, 11 months) in a study by Wallach and Sprott (1964) but the training failed to indicate clear-cut nonspecific transfer to a liquid quantity task (Wallach, Wall and Anderson, 1967). Sonstroem (In Bruner et al., 1966) found a combination of reversibility and verbal labeling instruction to be an effective means of inducing conservation of continuous quantity (solids). Similar significant reversibility instruction effects were found for length conservation by Murray (1968). These results together with a review of additional positive attempts to train children on the concrete operations period tasks lead Brainerd and Allen (1970) to conclude that the inversion-negation form of operational reversibility is a critical condition for successful conservation induction.

The immediate antecedent research upon which the present study rests focused upon classification and relationality (seriation) abilities. Sigel, Roeper and Hooper (1966) gave gifted preschool children (average Stanford-Binet I.Q. 143) structured small group experiences in multiple labeling of stimulus attributes, multiplicative classification and relationality, and a concluding session on reversibility aspects. Significant nonspecific transfer effects were found for substance and weight conservation. Sigel and Shantz in an unpublished study compared the performance of subjects

given multiple labeling and classification instruction to that of a control group (average age 4 years, 10 months) on quantity, weight, and area conservation tasks. They also found significant gains on quantity and weight conservation.

In an extensive follow-up investigation, Shantz and Sigel (1967) evaluated the effects of multiple labeling-classification instruction experiences as compared to discrimination-memory training of equal duration. Thirty-six kindergarten subjects who passed a pretest of relational term comprehension (Griffiths, Shantz and Sigel, 1967) and failed all conservation tasks were randomly assigned to a training condition (there were four labeling-classification groups and two discrimination-memory groups with 6 children and a teacher in each group). Posttesting revealed very little difference between the two instructional conditions in the percentage of successful subjects for quantity, number and area conservation (a control condition was not included). Conservation ability did not relate to any of the logical operations tasks, with the exception of low order, significant relationships between reversibility and number conservation, and classification skills and area conservation.

There are a number of other studies which deal with the role of classification abilities as they relate to logical thought development. Notable among these are the research with lower-class Negro kindergarten children (Sigel and Olmsted, 1967, 1970, in press) and the work of Parker and his associates (Parker and Ambron, 1970; Parker and Danielson, 1970; Parker and Halbrook, 1970; Parker and Levine, 1970). Although Mermelstein and Meyer (1969) found a lack of significant training effects for a number of instructional techniques including Beilin's verbal rule instruction and Sigel's classification approach, the degree of relevance in the replication procedures used and the meaningfulness of their transfer task sequence is certainly open to question (Brainerd and Allen, 1970).

The present research assumes the basic validity and developmental salience of the Piagetian logical operations skills. From this viewpoint, classification and relationality conceptual abilities are of particular importance, e.g., their complimentary role in the growth of a mature number concept (Piaget, 1952). There are a number of similarities between the present training procedures and the preschool instructional program of Kamii and her associates of Ypsilanti, Michigan. Thus, both emphasize experiences with pre-classification grouping and pre-seriation ordering activities. In contrast to the Ypsilanti program designed explicitly for disadvantaged children, the present study included only middle-class children in a university laboratory nursery.

This study may be viewed as a replication and extension of the Shantz and Sigel (1967) research. In addition to the labeling-classification and discrimination-memory training sessions, we included a seriation instruction condition and appropriate comparison control groups. It should also be pointed out that the average age of the children in the Shantz and Sigel study was approximately 5 years, 6 months whereas the present subjects represent two younger age categories; 3 years, 8 months, and 4 years, 7 months, respectively.

The classification training sessions, while retaining the general orientation of Shantz and Sigel, are derived from the classification task acquisition sequence of Kofsky (1966). These tasks were found to be rank-ordered in terms of difficulty as follows: (1) consistent sorting, (2) resemblance sorting, (3) "some" and "all", (4) exhaustive sorting, (5) multiple class membership, and (6) the whole is the sum of its parts (A + A'). This sequence became the organizational focus of the classification training program (see Appendix A for a complete description of the 12 instructional sessions).

The seriation training program also followed a developmental sequence. Children were given experiences in the following task settings: (1) comparisons between two sizes (absolute comparisons), (2) relative comparisons (unidimensional seriation), (3) serial correspondence, and (4) multiple seriation. A complete description of the seriation instructional sessions is found in Appendix B.

The memory-discrimination training program is adopted from Shantz and Sigel (1967) and follows from a theoretical analysis of the conventional conservation task format by Watson (1968). Watson's general operant discrimination analysis, stressing a non-mediational S-R orientation, conceives of the conservation task as consisting of three parts: (1) the initial static stimuli pair which establishes the state of quality, (2) the transformation of one stimulus, (3) the presentation of two perceptually different (but conceptually equal) static stimuli. Watson establishes the transformation interval or state as being the single most important element in the child's ability to conserve, i.e., it is the discriminative stimulus for correct conservation responses. This element is different from the static stimuli in that it is time-distributed, and it requires that the child not only discriminate the conservation transformation from a non-conservation transformation (such as adding something or taking something away), but he must also remember the transformation when phase three occurs. A similar view of the critical, essentially positive role for the transformational stimulus component is also presented by Beilin (1969_B).

Watson suggests that training the child to grasp the sequence of a series of changing events may induce conservation, e.g., training should emphasize the skills in attention, discrimination and memory for serial events, rather than emphasizing the logical operations postulated by Piaget. The primary aim of the present memory-discrimination instructional

sessions is "to facilitate children's ability to remember a sequence of actions, to visually analyze pictures for details as well as memory for details, and to increase their ability to verbally express their ideas." (Shantz and Sigel, 1967, p. C-8) The first sessions emphasize memory for action sequences, initially, gross motor movements (hands on head, hands behind back, etc.); then copying complex block designs; and, finally, repeating verbal messages. The second group of sessions involve use of pictures, whose details must be remembered; the creation of pictures whose details must be remembered; the creation of picture stories from individual items; and the invention of story segments. The last sessions deal with story reading followed by recall by the children. A complete description of the memory-discrimination training sessions is found in Appendix C.

In addition to the content-specific features of each of the three instructional programs certain general considerations guided all the present curriculum endeavors. Explicit immediate feedback, in the form of the teachers designations of "right"and "wrong" answers or action sequences, followed each child's responses. Later in the training sessions the children were encouraged to correct and evaluate each other's responses. Peer-group interactions were encouraged wherever possible. Explorations, descriptions, and general verbalization were stressed throughout the various instructional settings.

Each training format consisted of four age-matched children (two boys and two girls)meeting with an experienced preschool teacher in a small room separated from the general nursery area. Each session consisted of 20 - 30 minutes of organized activity and there were 12 sessions over a three week period for each training condition. The various control group children had an equivalent amount of separate small group activity with a preschool teacher.

The general characteristics of the various experimental subsamples are presented in Table 1. There were two age groups of 4 children each for each training and control condition.[2] Children matched for age were randomly assigned to conditions in each of the preschools involved. There were two pretest measures, the Peabody Picture Vocabulary Test and a test of relational terms comprehension (Griffiths, Shantz and Sigel, 1967), which were readministered following the training-enrichment interval.

(Insert Table 1 here)

The criterion dependent measures were administered in a posttest - only control group design, Campbell and Stanley (1963). This design selection was predicated upon the relatively small number of available preschool subjects and the commonly recognized "self-instructional" influence of pretesting in the Piagetian training literature (Beilin and Franklin, 1962; Sigel, 1968; Smedslund, 1961). The various curriculum-specific measures which represent near transfer tasks for the respective instructional conditions were as follows:

(A) Seriation task series:

(1) Absolute comparison which involves the ability to identify large and small members of different pairs of objects (2 trials).

(2) Relative comparison which involves the ability to identify the same object as now large, now small, depending upon the size of simultaneously present comparison figures (3 trials).

(3) Successive comparison (unidemensional seriation) which involves the ability to apply relative comparisons in systematic fashion to each of a number of simultaneously presented objects (one composite trial with a possible score 0 - 7).

(4) Additive seriation which involves the addition of three blocks within an ordered series (adapted from Elkind, 1964, score 0 - 3).

(5) Serial correspondence between two ordered arrays (adapted from Coxford, 1964, score 0 - 3).

(6) Multiple seriation which involves a series of drawings varying in two dimensions. This task requires that the subject fill in one empty cell on a strip of four cells with a picture that included both values of two continuous dimensions from which the strip is constructed. For example, a series of leaves were presented with the top leaf being large and light green, and the following leaves decreasing in size and increasing in darkness ending in a small dark leaf. The subject selects a leaf from four choices: one leaf is a duplicate leaf adjacent to the empty cell in the strip, one is correct on both values, and two leaves have only one correct value (i.e., correct on size and incorrect on shade, or the reverse). The position of choices was randomized across strip choice sheets.

A total of four strips were constructed from the same combination of dimensions as the classification matrices (see Table 2, below). The dimensions for the strips were continuous, however (such as shades of green) as compared to discontinuous in the classification matrices (color represented by green vs. yellow). The definitions of the continuous dimensions and values are presented below.

The four strips and choice sheets were presented by the administrator in a separate notebook one at a time in the following order: color-size (leaves) as the practice item; orientation-emptiness (bottles; number-color (tulips); and size-border (houses), Shantz and Sigel, 1967, pp. 11-13. The score range on this task was 0 - 3.

(Insert Table 2 here)

(B) Classification task series: (with the exception of task 7, all the classification tasks are taken from Kofsky's (1966) analysis of classification skills).

(1) Consistent sorting (score range 0 - 1)

(2) Exhaustive sorting (score range 0 - 1)

(3) Resemblance sorting (score range 0 - 1)

(4) Class inclusion ("some" and "all", score range 0 - 4)

(5) Multiple class membership (score range 0 - 4)

(6) Class addition (score range 0 - 4)

(7) Multiple classification (score range 0 - 3) This task requires that the subject fill in one empty cell of a four cell matrix (i.e., a 2-x-2 matrix) with a picture that includes both subclass attributes relevant to the matrix. For example, in a color (green-yellow) and size (big-little) matrix, a large yellow clock, a small yellow clock, and a large green clock were presented in a matrix; the correct picture for completion would be a small green clock. Subject selected a clock from four choices; two clocks were duplicates of cells adjacent to the empty cell, one clock had irrelevant

attributes, and one clock was correct. A total of four matrices were constructed from the following combinations of dimensions: color-size, orientation-emptiness, color-number, and border-size. The definitions of each dimension are presented below. The position of the correct choice was randomized across matrix sheets. The four matrices and choice sheets were presented by the administrator in a notebook one at a time in the following order: color-size matrix (clocks) served as a practice task to insure subject's understanding of the requirements of the task; orientation-emptiness (pitchers); number-color (apples) and size-border (trees). (Shantz and Sigel, 1967, pp. 11-13.)

(C) Memory-discrimination tasks: (These tasks were taken directly from the Illinois Test of Psycholinquistic Abilities, McCarthy and Kirk, 1963.)

(1) (1) Visual-Motor Sequencing

(2) Auditory-Vocal Sequencing

In addition to the above measures each subject received three conventional conservation tests. These conservation tasks are considered non-specific far transfer tasks in the present context.

(D) Conservation task series:

(1) Conservation of continuous quantity (3 trials with an empirical "check") This task was adopted from Shantz and Sigel (1967). In this test, two clay balls are used, one representing the standard and the other one transformed into a cup, a pancake, and a hot-dog shape. To avoid creating an "equality" in front of the child, two new balls are used at the beginning of each trial. To pass the test, the child must be able to recognize equality in spite of the irrelevant transformation and present an adequate explanation. A final "check-trial" was made by subtracting a piece from one ball, thus presenting the child with an unequal transformation.

(2) Conservation of Number (5 trials) In this task we adopted the procedure of Rothenberg (1969) using a display board painted in two distinctive colors and a series of colored poker chips. The colored poker chips were lined up on their respective colors and referred to as a "yellow bunch" or "blue bunch" throughout the test, thus assuring similarity of language and questions throughout. After a warm-up item of equal subtraction from both rows, five trials of various transformations made on the experimenter's row were administered. The transformations used are: 1) lateral displacement, 2) collapsing of one row, 3) resubgrouping, 4) equal addition to both rows, and 5) unequal addition. The last (unequal addition) acts as a "check-trial" for number conservation by creating a deliberate inequality.

(3) Conservation of surface area (3 trials with an empirical "check") This task is drawn directly from Shantz and Sigel (1967) and is a format similar to the one used by Piaget, Inhelder and Szeminska (1960). Two green blotters serve as "fields of grass" and two plastic cows are placed, one in each field, to "eat the grass". Red lego blocks, representing barns, are placed on the fields in three trials as follows: trial 1: three barns per field, trial 2: nine barns per field, and trial 3: six barns per field.

On the standard field, the barns are lined up in a row along one side of the field. On the other field, a transformation is used in which the barns are scattered at random about the field. A check-trial is used, in which the standard field receives five barns and the transformation field receives only four, thus establishing an inequality.

Directing our attention initially to the curriculum-specific dependent measures, the results of the present study may be briefly summarized. Since analysis of the pretest Peabody Picture Vocabulary Test I.Q. means (Table 1) indicated a significant difference between treatment groups in preschool-A (the seriation training-I group was significantly superior), the following general comparisons included both analyses of variance and analyses of covariance with P.P.V.T. pretest I.Q. score as the covariate. Considering the classification task series, Table 3 presents the various individual subscores and the total scores for the respective subsamples. A 3 x 2 (treatment by age-level) factorial analysis of variance and a corresponding covariance analysis failed to indicate any significant main effects or interactions for the preschool-A total classification scores. The anticipated posttraining superiority of the groups which had classification instruction are notably absent, i.e., the total score combined age group means are 7.625, 8.750, and 9.625 for the classification, control, and seriation groups, respectively. In addition, inspection of the Table 3 subtask score patterns fails to reveal any marked differences among the experimental subsamples. A similar lack of significant differences was shown in an analysis of variance for the total classification scores in preschool-B.

In contrast, the seriation task series results presented in Table 4 reveal clearcut distinctions for the preschool-A children. The factorial analysis of variance utilizing the total seriation scores indicated a significant main effect for age-levels, $F = 5.72$, $df = 1/18$, $p < .05$, and treatment conditions, $F = 9.27$, $df = 2/18$, $p < .01$, and a significant

age-level/treatment interaction, $F = 4.72$, df 2/18, $p < .05$. In essential accord with these results, the factorial analysis of covariance indicated a significant treatments main effect, $F = 6.71$, df = 2/17, $p < .05$, and a significant age-level/treatment interaction, $F = 4.63$, df = 2/17, $p < .05$. Inspection of the various group total score means (Table 4) shows a uniform superiority for the seriation training conditions. With regard to the age-level/treatment interaction, individual comparisons indicated significant differences favoring the high age-level seriation-I subjects, $F = 12.01$, df = 1/17, $p < .01$, and the high age-level control-I subjects, $F = 5.71$, df = 1/17, $p < .05$, over their low age-level counterparts, and a contrasting low age-level classification-II score superiority which fails to reach significance, $F = 1.43$, df = 1/17, $p < .25$. Thus, the total mean score comparisons for the seriation vs. the control groups indicate similar differences (12.50 vs. 7.00 and 19.71 vs. 12.0) for the two age-levels, whereas the superiority of the seriation training condition over the classification condition is notably greater at the high age-level (19.71 vs. 9.25) than that shown for the younger subjects (12.50 vs. 11.75).

In addition to these seriation total score results, Table 4 indicates notable superiority for both the seriation training groups on subtasks 3, successive comparisons, and 5, serial correspondence. The older seriation training-I group demonstrated distinctly higher scores on subtask 2, relative comparisons and subtask 6, multiple seriation. These results, in conjunction with the total seriation score analyses, clearly substantiate the anticipated specific transfer effects of an instructional program designed to encompass the various fundamentals of seriation ability. The analysis of variance results for the total seriation scores for the pre-school-B children failed to reveal any significant differences among the experimental or control groups.

The Illinois Test of Psycholinguistic Abilities subtest score values, which are considered as specific transfer tasks for the memory-discrimination training groups, are presented in Table 5. Considering the relevant instructional setting, preschool-B, a cursory examination reveals very little difference in the subgroup means. This is bourne out in the analyses of variance results in which the visual-motor sequencing and the auditory-vocal sequencing tasks yielded treatment F values of .5522 and .0749, df 2/8, respectively. There is no indication, therefore, of a training induced improvement for memory-discrimination instruction insofar as the present criterial tasks and age groups are concerned. A similar lack of treatment main effects or interactions was found in the factorial analyses of covariance for preschool-A, although the main effect for age-levels was significant ($F = 4.688$, $df = 1/17$, $p < .05$) for the Visual-Motor Sequencing subtest. These age-level differences for the classification and seriation group children are in the direction to be expected from the conventional test norms.

The results with regard to the planned nonspecific or for transfer tasks are distinctly nonambiguous. 3 subjects of the overall sample of 36 from both preschool settings were classified as conservers, i.e., 1 child from the low age-level memory discrimination-II group and 1 child from the control group of preschool-B passed the number conservation task, and 1 child from the low age-level classification II condition passed the quantity conservation task. In addition, there was very little change in the P.P.V.T. I.Q. scores (Table 1) from pretesting to posttesting following training for the various experimental conditions. The only significant improvement was shown by the classification training - II group, $t = 2.53$, $df = 6$, $p < .025$. The present intervention procedures, thus had a very limited effect upon task situations designated as generalization or nonspecific transfer of training indices.

The implications of the present investigation considered as a single effort are rather straightforward. In contrast, the interpretation of these results in conjunction with previous related studies is much less

clearcut. The classification and memory-discrimination instructional conditions did not produce the anticipated specific generalization on the respective criterial measures. Conversely, seriation training was notably effective in demonstrating distinctive specific transfer to tasks which were integral components of the particular curriculum design. Moreover, the seriation trained groups indicated a fairly uniform, although non-significant, score superiority on the classification task series and the I.T.P.A. auditory-vocal subtest as compared to their classification training counterparts.[3] Classification instruction also failed to indicate any influence on seriation or memory-discrimination measures. A similar lack of effect was shown by the memory-discrimination condition.

The differences between the high and low age-level classification trained subjects on the seriation measures (Table 4) merit some comment. Assuming the control condition subjects score patterns as representative of normative age related changes, the lower seriation scores (subtasks 3, 4, and total score) shown by the older classification-trained children are surprising. In this regard, Shantz and Sigel (1967) found a drop in multiple seriation scores on posttesting for a group of children trained on multiple labeling-classification skills.

In comparison to the antecedent investigations, the most distinctive exception in the present results concerns the lack of nonspecific far transfer effects. Although the classification training-II group did show a significant P.P.V.T. I.Q. score increment following instruction, there was no consistent carryover from any of the instructional programs to conservation acquisition. This result, while certainly encompassed by the Genevan viewpoint regarding the role of training or instruction in conservation acquisition, fails to accord with the earlier findings of Shantz and Sigel (1967) and Sigel, Roeper and Hooper (1966). There are three related

essential distinctions between the earlier research and the present case which may reconcile the contrary findings. First, the present classification instructional curriculum (Appendix A) adapted the Sigel multiple labeling and classification program format but applied it to a new, developmentally based, sequence, i.e., the task difficulty series reported by Kofsky (1966). The degree to which this new application vitiates the replication aspects of the present study is unknown.

A second major distinction concerns the assessment design of the various investigations. The present comparisons are drawn from a "posttest only" design, while Sigel and Shantz (1967) and Sigel, Roeper and Hooper (1966) used the conventional pretest-posttest transfer of training design. Acknowledging the demonstrated influence of the testing situation itself on Piagetian concept performance, the Shantz and Sigel (1967) results may be biased to an unknown degree since a null control condition was not included in the experimental design. Additionally, although the Sigel, Roeper, and Hooper (1966) assessment design included control groups, the presence of pretest x instructional treatment interactions are present to an unknown degree.[4]

The final distinction centers upon the ages of the experimental subjects in the various logical operations training studies. The present children, especially those subjects in the training-II conditions, are clearly younger than their counterparts in the Shantz and Sigel (1967) study or in the great majority of the conservation training studies reported in the experimental literature, Brainerd and Allen (1970). In the case of Sigel, Roeper, and Hooper (1966), while the chronological age-ranges approximate those reported here, the mental ages of their gifted children were probably in the 6-8 year range. The present seriation training results on the seriation task series and the marked absence of far

transfer to the conservation tasks emphasize the critical role of age-related developmental status as a contributing factor in manipulatory studies of cognitive growth.

The major positive aspects of the present research stem directly from the results of the seriation instructional program. These results certainly indicate that an operational preschool curriculum is a feasible derivative of an empirically demonstrated developmental acquisition sequence. Recall that the observed developmental order of mastery provided the curriculum sequence or hierarchy, the content areas, and the specific dependent tasks through which the evaluative assessment was realized.[5] While extrapolations to subject populations beyond the present middle-class children should be made cautiously, it is noteworthy that a group of 5 to 6 year-old lower-class, disadvantaged children demonstrated adequate competence in unidimensional seriation and serial correspondence tasks similar to those employed in this study, Hooper (1969). Thus, the implementation of a preschool curriculum which includes seriation-relationality concepts as an integral aspect may have quite general application relevance.

In conclusion, we should return to the fundamental contention of the organismic orientation as it applies to preschool curriculum design - the essential salience of the individual child's developmental status. As this study has amply shown, the developmental status of the curriculum target population will determine to a great extent the success or failure of an educational intervention effort. While this conclusion may appear "simple minded" to any competent nursery or preschool specialist, it runs counter to the traditional environmentalistic orientation which has characterized most learning theorists. The failure to induce nonspecific far transfer insofar as the operationally complex conservation tasks are concerned,

essentially supports the recent statements of Beilin (1969_A), and Inhelder and Sinclair-de-Zwart (1969). It is clear that a major role should be assigned to the age-related maturational components in any attempt to modify the course of cognitive development or to mitigate the detrimental aspects of sociocultural impoverishment. In this respect the clear acknowledgment of individual factors, insofar as maturational and sequentially invariant developmental patterns are concerned, makes an organismic orientation the essential prerequisite for a viable preschool curriculum endeavor.

Aebli, H. Didactique psycholgique: Application à la didactique de la psychologie de Jean Piaget. Neuchâtel: Delachaux et Niestle, 1951.

Albee, G. W., et al. Statement by the Society for the Psychological study of Social Issues on current I.Q. controversy: Heredity versus environment. American Psychologist, 1969, 24, (11), 1039-1040.

Athey, I. J. & Rabadau, D. O., (Eds.), Educational Implications of Piaget's Theory: A Book of Readings. Waltham, Mass.: Blaisdell, 1970.

Baltes, P. B. Longitudinal and cross-sectional sequences in the study of age and generational effects. Human Development, 1968, 11, 145-171.

Beard, R. M. An Outline of Piaget's Developmental Psychology For Students and Teachers. New York: Basic Books, 1969.

Bearison, D. J. Role of measurement operations in the acquisition of conservation. Developmental Psychology, 1969, 1 (6), 653-660.

Beilin, H. Perceptual-cognitive Conflict in the Development of an Invariant Area Concept. Journal of Experimental Child Psychology, 1964, 1, 208-226.

Beilen, H. Learning and Operational Convergence in Logical Thought Development. Journal of Experimental Child Psychology, 1965, 2, 317-339

Beilin, H. Feedback and Infralogical Strategies in Invariant Area Conceptualization. Journal of Experimental Child Psychology, 1966, 3 (3), 267-278.

Beilin, H. Developmental stages and developmental processes. Paper presented at the Invitational Conference on Ordinal Scales of Cognitive Development. Monterey, California: California Test Bureau, 1969_A.

Beilin, H. Stimulus and cognitive transformation in conservation. In Elkind, D. and Flavell, J. H. (Eds.), Studies in Cognitive Development: Essays in Honor of Jean Piaget. New York: Oxford University Press, 1969_B.

Beilin, H., and Franklin, I. C. Logical Operations in Area and Length Measurement: Age and Training Effects. Child Development, 1962, 33, 607-618.

Beilin, H. and Kagan, J. Pluralization Rules and the Conceptualization of Number. Developmental Psychology, 1969, 1, 697-706.

Brainerd, C. J. and Allen, T. W. Experimental Inductions of the Conservation of "First-Order" quantitative Invariants. Psychological Bulletin, In press.

Brearly, M. and Hitchfield, E. A Guide To Reading Piaget. New York: Schocken Books, 1969.

Bruner, J. S. et al. Studies in Cognitive Growth. New York: Wiley, 1966.

Bruner, J. S. The Process of Education. Cambridge, Massachusetts.: Harvard University Press, 1960.

Campbell, D. T., and Stanley, J. C. Experimental and quasi-experimental Designs for Research. In Handbook of Research on Teaching. Chicago: Rand McNally, 1963.

Cicirelli, V. G., et al. The Impact of Head Start: An Evaluation of the Effects of Head Start on Children's Cognitive and Affective Development. The report of a study undertaken by Westinghouse Learning Corporation and Ohio University under contract B89-4536 dated June 20, 1968 with the Office of Economic Opportunity (Washington, D. C.: Office of Economic Opportunity, June 12, 1969).

Cicirelli, V. G., Evans, J. W., and Schiller, J. S. The Impact of Head Start: A Reply to the Report Analysis. Harvard Educational Review, 1970, 40 (1), 105-129.

Coxford, A. F. The Effects of Instruction on Stage Placement in Piaget's Seriation Experiments. The Arithmetic Teacher, 1964, 1, 4-9.

Elkind, D. Discrimination, Seriation, and Numeration of Size and Dimensional Differences in Young Children: Piaget Replication Study VI. Journal of Genetic Psychology, 1964, 104, 275-296.

Elkind, D. Piaget and Montessori. Harvard Educational Review, 1967, 37 (4), 535-545.

Elkind, D. The Case For the Academic Preschool: Fact or Fiction? Young Children, 1970, 25 (3), 132-141.

Flavell, J. H. The Developmental Psychology of Jean Piaget. Princeton, N. J.: Van Nostrand, 1963.

Flavell, J. H. and Wohlwill, J. F. Formal and Functional Aspects of Cognitive Development. In Elkind, D. and Flavell, J. H. (Eds.), Studies in Cognitive Development: Essays in Honor of Jean Piaget. New York: Oxford University Press, 1969.

Furth, H. G. Piaget and Knowledge: Theoretical Foundations. Englewood Cliffs, N. J.: Prentice-Hall, 1969.

Furth, H. G. Piaget for Teachers. Englewood-Cliffs, N. J.: Prentice-Hall, 1970.

Gagné, R. M. Contributions of Learning To Human Development. Psychological Review, 1968, 75, 177-191.

Gelman, R. Conservation Acquisition: A Problem of Learning to Attend to Relevant Attributes. Journal of Experimental Child Psychology, 1969, 7, 167-187.

Ginsburg, H. & Opper, S. Piaget's Theory of Intellectual Development: An Introduction. Englewood Cliffs, N. J.: Prentice-Hall, 1969.

Goulet, L. R. Training, Transfer & The Development of Complex Behavior. Privately Distributed Mimeographed Paper. Department of Psychology, University of Illinois, 1970.

Griffiths, J. A., Shantz, C. U., and Sigel, I. E. A Methodological Problem in Conservation Studies: The Use of Relational Terms. Child Development 1967, 38, 841-848.

Gruen, G. Experiences Affecting the Development of Number Conservation in Children. Child Development, 1965, 36 (4), 963-979.

Hooper, F. H. Piagetian Research and Education. In Sigel, I. E. and Hooper, F. H. (Eds.), Logical Thinking In Children: Research Based on Piaget's Theory. New York: Holt, Rinehart and Winston, 1968, (pp. 423-434)

Hooper, F. H. The Appalachian Child's Intellectual Capabilities - Deprivation or Diversity? The Journal of Negro Education Yearbook, 1969, 38, (3), 224-235.

Hooper, F. H. Review of: Beard, R. M., An Outline of Piaget's Developmental Psychology for Students and Teachers., and Brearly, M., and Hitchfield, E., A Guide To Reading Piaget., Harvard Educational Review, 1970, 40, (1), 146-153.

Hooper, F. H., and Marshall, W. H. The Initial Phase of a Preschool Curriculum Development Project. Final Report, United States Department of Health, Education, and Welfare, Office of Education Contract No. O.E.C. 3-7-062902-3070.

Hunt, J. Mc V. Intelligence and Experience. New York: The Ronald Press, 1961.

Inhelder, B. Some Aspects of Piaget's Genetic Approach to Cognition. In Kessen, W. and Kuhlman, C. (Eds.) Thought in the Young Child. Monographs of the Society for Research in Child Development, 1962, 27, 19-34.

Inhelder, B. and Sinclair-de-Zwart, H. Learning Cognitive Structures. In Mussen, P. H., Langer, J. and Covington, M. (Eds.), Trends and Issues In Developmental Psychology. New York: Holt, Rinehart, & Winston, 1969.

Jensen, A. R. How Much Can We Boost I.Q. and Scholastic Achievement? Harvard Educational Review, 1969_A, 39, 1-123.

Jensen, A. R. Criticism or Propaganda? American Psychologist, 1969_B, 24, (11), 1040-1041.

Kamii, Constance, & Radin, Norma. A Framework for a Preschool Curriculum Based on Piaget's Theory. In I. J. Athey & D. O. Rubadau (Eds.) Educational Implications of Piaget's Theory: A Book of Readings. Waltham, Mass.: Blaisdell, 1970.

Kingsley, R. C., & Hall, V. C. Training Conservation Through the Use of Learning Sets. Child Development, 1967, 38 (4), 1111-1126.

Kofsky, E. A Scalogram Study of Classificatory Development. Child Development, 1966, 37, (1), 191-204.

Kohlberg, L. Early Education: A Cognitive - Developmental View. Child Development, 1968, 39, 1013-1062.

Langer, J. Theories of Development. New York: Holt, Rinehart, & Winston, 1969.

Mermelstein, E., and Meyer, E. Conservation Training Techniques and Their Effects on Different Populations. Child Development, 1969, 40, 471-490.

McCarthy, J. J., and Kirk, S. A. The Construction, Standardization and Statistical Characteristics of the Illinois Test of Psycholinguistic Abilities, Champaign-Urbana, 1963.

Murray, F. Cognitive Conflict and Reversibility Training in the Acquisition of Length Conservation. Journal of Educational Psychology, 1968, 59, 82-87.

Parker, R. K., and Ambron, S. A Comparison of the Matrix and Overlapping Rings in Teaching Multiple Classification to Young Children. Research Proposal, Center for Advanced Study in Education, City University of New York, 1970.

Parker, R. K. Ambron, S., Danielson, G. I., Halbrook, M. C. and Levine, J. A. Overview of Cognitive and Language Programs for 3, 4, & 5, year old Children. Center for Advanced Study in Education, The City University of New York, 1970.

Parker, R. K., and Danielson, G. I. Effects of Instructional Programs on Classification Skills. Research Proposal, Center for Advanced Study in Education, City University of New York, 1970.

Parker, R. K., and Halbrook, M. C. The Learning and Transfer of Double Classification Skills From Perceptual to Functional and Abstract Attributes. Research Proposal, Center for Advanced Study in Education, City University of New York, 1970.

Parker, R. K., and Levine, J. A. Instruction in Representation and its Effect Upon Classification Skills. Research Proposal, Center for Advanced Study in Education, City University, New York, 1970.

Piaget, J. The Child's Conception of Number. London: Routledge, 1952.

Piaget, J. Development and Learning. In Ripple, R. E. & Rockcastle, V. N., (Eds.) Piaget Rediscovered. New York: Cornell University, 1964.

Piaget, J., Inhelder, B., and Szeminska, A. The Child's Conception of Geometry. New York: Basic Books, 1960.

Pinard, A. and Laurendeau, M. "Stage" in Piaget's Cognitive - Developmental Theory: Exegesis of a Concept. In Elkind, D. and Flavell, J. H. (Eds.) Studies in Cognitive Development: Essays in Honor of Jean Piaget. New York: Oxford University Press, 1969.

Reese, H. W. and Overton, W. F. Models of Development and Theories of Development. In Goulet, L. R. and Baltes, P. B. (Eds.). Life-Span Developmental Psychology: Research and Theory. New York: Academic Press, 1970.

Ripple, R. F. & Rockcastle, V. N., (Eds.), Piaget Rediscovered. Ithica, N.Y.: Cornell University Press, 1964.

Rothenberg, B. Conservation of Number Among Four and Five-Year-Old Children: Some Methodological Considerations. Child Development, 1964, 40, (2), 383-406.

Rothenberg, B., & Orost, J. H. The Training of Conservation of Number in Young Children. Child Development, 1969, 40, (3), 707-726.

Shantz, C. U., and Sigel, I. E. Logical Operations and Concepts of Conservation in Children: A Training Study, 1967, Final Report: Project No. 6-8463, U. S. Department of Health, Education and Welfare.

Sigel, I. E. "Reflections", In Sigel, I. E. and Hooper, F. H. (Eds.). Logical Thinking in Children: Research Based on Piaget's Theory. New York: Holt, Rinehart, and Winston, 1968, (Chapter 7, pp. 504-524).

Sigel, I. E. The Piagetian System and the World of Education. In Elkind, D. and Flavell, J. H. (Eds.). Studies in Cognitive Development: Essays in Honor of Jean Piaget. New York: Oxford University Press, 1969.

Sigel, I. E., and Hooper, F. H. Logical Thinking in Children: Research Based on Piaget's Theory: New York: Holt, Rinehart, and Winston, 1968.

Sigel, I. E., and Olmsted, P. P. Modification of Cognitive Skills Among Lower-Class Black Children: A Follow-Up Longitudinal Study. In: Helmuth, J. (Ed.) The Disadvantaged Child. Bruner & Mazel, (In Press).

Sigel, I. E., and Olmsted, P. P. Modification of Classificatory Competence and Level of Representation Among Lower-Class Negro Kindergarten Children. In: Passow, H. A. (Ed.) Reaching the Disadvantaged Learner. New York: Columbia University Teachers College Press, 1970.

Sigel, I. E., and Olmsted, P. P. Styles of Categorization Among Lower-Class Kindergarten Children. Paper presented at the American Educational Research Association Annual Meeting, New York City, 1967.

Sigel, I. E., Roeper, A., and Hooper, F. H. A Training Procedure for Acquisition of Piaget's Conservation of Quantity: A Pilot Study and Its Replication. British Journal of Educational Psychology, 1966, 36, 301-311.

Sigel, I. E., and Shantz, C. U. A Study of Classification Training in Conservation Acquisition. Cited in Shantz, C. U. & Sigel, I. E. Logical Operations and Concepts of Conservation in Children: A Training Study, 1967. Final Report: Project No. 6-8463, U. S. Department of Health, Education, and Welfare.

Sinclair-de-Zwart, H. Developmental Psycholinguistics. In Elkind, D. and Flavell, J. H. (Eds.), Studies in Cognitive Development: Essays in Honor of Jean Piaget. New York: Oxford University Press, 1969.

Smedslund, J. The Acquisition of Conservation of Substance and Weight in Children: II External Reinforcement of Conservation of Weight and of the Operations of Addition and Subtraction. Scandanavian Journal of Psychology, 2, 71-84.

Smith, I. D. The Effects of Training Procedures Upon the Acquisition of Conservation of Weight. Child Development, 1968, 39 (2), 515-526.

Smith, M. S., and Bissell, J. S. Report Analysis: The Impact of Head Start. Harvard Educational Review, 1970, 40, (1), 51-104.

Sonquist, H., & Kamii, C. Applying Some Piagetian Concepts in the Classroom for the Disadvantaged. Young Children, 1967, 22, 231-245.

Stendler, C. B. Aspects of Piaget's Theory That Have Implications for Teacher Education. Journal of Teacher Education, 1965, 16, 329-335.

Vernon, Philip E. "Genes, 'g', and Jensen." Review of Environment, Heredity and Intelligence by A. R. Jensen. Contemporary Psychology, 1970, 15 (3), 161-163.

Wallace, J. G. Concept Growth and the Education of the Child. The Mere, Upton Park, Slough Bucks: National Foundation for Educational Research in England and Wales, 1965.

Wallach, L. and Sprott, R. L. Inducing Number Conservation in Children. Child Development, 1964, 35, 1057-1071.

Wallach, L., Wall, J., and Anderson, L. Number Conservation: The Roles of Reversibility, Addition-Subtraction, and Misleading Perceptual Cues. Child Development, 1967, 38, 425-442.

Watson, J. S. The Development and Generalization of "Contingency Awareness" in Early Infancy: Some Hypotheses. Merrill-Palmer Quarterly of Behavior and Development, 1966, 12 (2), 123-135.

Watson, J. S. Memory and "Contingency Analysis" in Infant Learning. Merrill-Palmer Quarterly of Behavior and Development, 1967, 13, 55-76.

Watson, J. S. Conservation: An S-R Analysis. In Sigel, I. E., and Hooper, F. H., (Eds.) Logical Thinking in Children: Research Based on Piaget's Theory. New York: Holt, Rinehart and Winston, 1968, (pp. 447-460.)

Watson, J. S. Cognitive-Perceptual Development in Infancy: Setting for the Seventies. Paper Presented at the Merrill-Palmer Conference on Research and Teaching of Infant Development Meetings, Detroit, Michigan, February, 1970.

Werner, H., and Kaplan, E. Symbol Formation. New York: John Wiley and Sons, 1963.

Wohlwill, J. F. Piaget's System As a Source of Empirical Research. The Merrill-Palmer Quarterly, 1963, 4, 253-262.

Wohlwill, J. F. Methodology and Research Strategy in the Study of Developmental Change. In Goulet, L. R., and Baltes, P. B. (Eds.) Life-Span Developmental Psychology: Research and Theory. New York: Academic Press, 1970 in press.

FOOTNOTES

[1]The preschool research project reported here is the result of a cooperative effort by Mrs. Wanda Franz, Research Assistant, the Division of Family Resources, West Virginia University, Mrs. Carolyn Kincaid, Director of the West Virginia University Laboratory Nursery, and the present author. We acknowledge the assistance and cooperation of Mrs. Lee McIntyre, Director of the ABC Village Day Care Center of Morgantown, West Virginia, and Diane Papalia, Mrs. Sherrie Wyant, and Joseph Fitzgerald of West Virginia University. Acknowledgment is also extended to Dr. Carolyn Shantz of the Merrill-Palmer Institute, Detroit, Michigan and Dr. Constance Kamii, Curriculum Director of the Ypsilanti, Michigan Early Education Program for the extensive use of curriculum outlines and programs.

[2]An unfortunate loss of subjects in the preschool-B setting prior to post-testing required the combining of the control children into a single group of intermediate age range characteristics, i.e., see Table 1. There was very little difference among the group performances, except for control group-II, on the relational terms pretest which has 3 subparts, each with a score range of 0-3, Griffiths, Shantz, and Sigel (1967).

[3]It should be recognized that the present experimental effects are potentially confounded by teacher differences, i.e., one instructor worked with the classification and memory-discrimination groups, one instructor worked with the seriation instructional groups, while a third teacher conducted all of the control group experiences. However, the author has no information which indicates differential teacher effectiveness and this was substantiated by periodic interviews during the instructional period and observation of television tape recordings of the training conditions.

[4]Until adequate psychometric data concerning the reliability and validity of Piagetian tasks in general, and the present criterial measures in particular, are available, the possible confounding effects of repeated tasks administrations in developmental training research shall inevitably be present (Baltes, 1968; Wohlwill, 1970). A small additional matched control group (N=3) which received both pretests and posttests on the present task arrays showed one subject (age - 4 years, 8 months) who conserved number on pretesting but failed the task on posttesting. The only experimentally adequate design for research of the present type would appear to be the relatively demanding Solomon Four Group Design, Case 5, in Campbell and Stanley (1963).

[5]Insofar as the observed seriation task difficulty levels are concerned, there was one notable departure from the sequence reported by Elkind (1964), in the present results. Contrary to Elkind's findings, task 3 (successive comparisons) appears to be more difficult than task 4 (additive seriation). The percentage of subjects in the present overall sample passing these tasks was (Task 3) 50% as compared to (Task 4) 79%, respectively.

Table 1

General Characteristics of the Subject Samples*

	Age-Ranges (years & months)	Mean Ages (years & months)	PPVT Means	I.Q. (Pretest) S.D.	PPVT Means	I.Q. (Posttest) S.D.	Relational Terms Means	(Pretest) S.D.
Preschool - A								
Classification Training - I	4,3 - 4,8	4,4	108.80	8.58	112.00	9.35	7.75	1.64
Classification Training - II	3,4 - 4,1	3,8	106.30	7.29	118.25	6.06	5.25	2.59
Seriation Training - I	4,5 - 4,9	4,7	122.00	9.14	120.50	9.01	9.00	0.00
Seriation Training - II	3,4 - 4,2	3,8	105.00	17.71	114.70	11.78	6.25	1.79
Control Group - I	4,3 - 5,1	4,7	102.50	9.23	112.20	9.98	5.75	3.42
Control Group - II	3,0 - 4,1	3,7.5	102.80	6.61	107.30	10.94	2.75	3.70
Preschool - B								
Memory - Discrim. Training - I	4,7 - 4,11	4,8	113.30	5.31	109.00	3.00	9.00	0.00
Memory - Discrim. Training - II	3,8 - 4,3	4,0	114.80	14.94	112.50	28.19	9.00	0.00
Control Group	4,0 - 4,5	4,3	112.00	11.23	120.75	12.49	9.00	0.00

* N = 4 in all cases

Table 2

Definitions of Dimensions on
Multiple Classification and Seriation Tasks*

Dimensions	Symbol	Classification	Seriation
Color	C	Yellow vs. green Red vs. green	Four values: Light green to dark green Light red to dark red
Size	S	Big vs. little	Four values: Big to little
Orientation	O	Up vs. tilted	Four values: $0°$ (up) $45°$ (upward tilt) $135°$ (downward tilt) $180°$ (upside down)
Number	N	2 vs. 3	1, 2, 3, 4
Border	B	Entirely bordered vs. no border	1/4 bordered 1/2 bordered 3/4 bordered totally bordered
Emptiness	E	Full vs. 1/4 full	Full 3/4 full 1/2 full 1/4 full

* From: Shantz and Sigel (1967, pp. 13)

Table 3

Means and Standard Deviations of the
Classification Task Series*

	Task 1		Task 2		Task 3		Task 4	
	Means	S.D.	Means	S.D.	Means	S.D.	Means	S.D.
Preschool - A								
Classification Training - I	1.00	--	1.00	--	.75	.43	2.50	.50
Classification Training - II	1.00	--	.50	.50	.50	.50	2.25	.43
Seriation Training - I	1.00	--	1.00	--	1.00	1.00	3.50	.50
Seriation Training - II	1.00	--	.75	.43	.75	.43	2.75	.83
Control Group - I	1.00	--	.75	.43	.75	.43	2.50	.87
Control Group - II	1.00	--	.75	.43	1.00	1.00	2.25	.43
Preschool - B								
Memory - Discrim. Training - I	1.00	--	.75	.43	1.00	1.00	2.25	1.09
Memory - Discrim. Training - II	.75	.43	.75	.43	1.00	1.00	3.25	.83
Control group	1.00	--	.50	.50	1.00	1.00	2.75	.83

* Task Designations: 1 = Consistent Sorting (Score range = 0-1)
2 = Exhaustive Sorting (Score range = 0-1)
3 = Resemblance Sorting (Score range = 0-1)
4 = Class Inclusion (Score range = 0-4)

Table 3 (continued)

	Task 5 Means	Task 5 S.D.	Task 6 Means	Task 6 S.D.	Task 7 Means	Task 7 S.D.	Total Score Means	Total Score S.D.
Preschool - A								
Classification Training - I	1.75	.83	.25	.43	1.00	.71	8.25	.43
Classification Training - II	2.25	.43	0.00	--	.50	.87	7.00	1.58
Seriation Training - I	3.00	.71	0.00	--	1.00	1.00	10.50	1.66
Seriation Training - II	2.50	.87	.50	.87	.50	.50	8.75	1.92
Control Group - I	2.50	.50	.25	.43	1.50	.87	9.25	2.28
Control Group - II	2.00	.71	.25	.43	1.00	.71	8.25	1.92
Preschool - B								
Memory - Discrim. Training - I	1.75	.43	0.00	--	.50	.50	7.25	1.79
Memory - Discrim. Training - II	3.25	.83	.50	.87	.25	.43	9.75	1.92
Control Group	2.75	.83	0.00	--	1.00	.71	9.00	1.73

* Task Designations: 5 = Multiple Class Membership (Score range = 0-4)
6 = Class Addition (Score range = 0-2)
7 = Multiple Classification (Score range = 0-3)

Table 4

Means and Standard Deviations of the Seriation Task Series*

	Task 1		Task 2		Task 3		Task 4	
	Means	S.D.	Means	S.D.	Means	S.D.	Means	S.D.
Preschool - A								
Classification Training - I	2.00	--	.50	.50	3.25	2.28	1.50	1.12
Classification Training - II	2.00	--	.50	.50	4.50	1.80	3.00	--
Seriation Training - I	2.00	--	2.25	.83	7.00	--	3.00	--
Seriation Training - II	1.75	.43	.50	.50	5.00	1.58	2.50	.50
Control Group - I	2.00	--	.25	.43	4.25	2.95	2.75	.43
Control Group - II	2.00	--	1.00	.71	2.25	1.92	.75	.83
Preschool - B								
Memory - Discrim. Training - I	2.00	--	0.00	--	4.00	2.55	1.50	.87
Memory - Discrim. Training - II	2.00	--	.50	.87	4.50	2.50	2.25	.83
Control Group	2.00	--	.25	.43	5.25	2.05	1.75	1.30

* Task Designations: 1 = Absolute comparison (Score range = 0-2)
2 = Relative comparison (Score range = 0-3)
3 = Successive comparison (Score range = 0-7)
4 = Additive seriation (Score range = 0-3)

Table 4 (continued)

	Task 5 Means	Task 5 S.D.	Task 6 Means	Task 6 S.D.	Total Score Means	Total Score S.D.
Preschool - A						
Classification Training - I	1.25	1.09	.75	.83	9.25	3.42
Classification Training - II	1.50	.50	.25	.43	11.75	2.38
Seriation Training - I	3.00	—	2.50	.50	19.71	.83
Seriation Training - II	2.25	.43	.25	.43	12.50	2.60
Control Group - I	2.00	1.00	.75	.43	12.00	4.53
Control Group - II	1.25	.83	.25	.43	7.00	1.73
Preschool - B						
Memory - Discrim. Training - I	1.00	1.22	.50	.50	9.00	4.64
Memory - Discrim. Training - II	1.75	1.30	.50	.50	11.50	3.35
Control Group	.25	.43	.25	.43	9.75	2.77

* Task Designations: 5 = Serial correspondance (Score range = 0-3)
6 = Multiple Seriation (Score range = 0-3)

Table 5

Means and Standard Deviations of
I.T.P.A. Subtest Scores*

	Visual-Motor Sequencing		Auditory-Vocal Sequencing	
	Means	S.D.	Means	S.D.
Preschool - A				
Classification Training - I	13.00	2.55	16.75	1.64
Classification Training - II	9.75	4.92	7.00	5.00
Seriation Training - I	13.00	2.12	18.00	1.22
Seriation Training - II	9.50	.50	14.00	8.09
Control Group - I	11.75	1.92	17.25	.83
Control Group - II	12.00	7.62	18.25	5.02
Preschool - B				
Memory - Discrim. Training - I (N=3)	11.67	2.85	18.33	3.32
Memory - Discrim. Training - II	11.00	.71	20.00	2.55
Control Group	10.75	2.68	21.00	3.67

* (N = 4, unless indicated)

APPENDIX A

MULTIPLE CLASSIFICATION TRAINING SESSIONS

The sequence of concepts outlined below are based on Kofsky's scalogram study (1966) of the development of classification. The training sessions in classification skills follow this sequence to a certain level within each session and progress in complexity to the twelfth session.

The developmental sequence is as follows:

1. Consistent sorting
2. Resemblance sorting
3. Some and all
4. Exhaustive sorting
5. Multiple class membership
6. Whole is the sum of its parts

Whenever possible the teacher will always call upon a child to correct another child, verbally and by actively manipulating the objects. Each session will proceed in a game-like way. Verbal reinforcement will be given for a correct response.

The type of materials used differs quantitatively and qualitatively as the sessions proceed. There are more objects with fewer attributes in the beginning sessions. The later sessions utilize fewer objects with more attributes.

These twelve sessions were based upon the labeling-classification training sessions from the training study by Shantz and Sigel, 1967; the Ypsilanti Early Education Program presently in operation; and the training study by Sigel, Roeper and Hooper, 1966, for the acquisition of Piaget's conservation of quantity.

Session I

Materials: 4 small boxes; shells - 4 snails, 4 scallops, 4 conchs, 4 clams; round buttons - 4 red, 4 blue, 4 pink, 4 green.

A. 1. Introduce buttons.
Identify and discuss, use and shape.
2. Ask Ss to identify the different colors by pointing to buttons.
3. Ask Ss if some of the buttons look just the same or look alike.
4. Place 4 boxes on table. Have all Ss put those buttons together in a box that are just the same, just alike, or put the buttons together that go together.
5. Empty boxes. Mix the buttons and have one S put the buttons together that go together. Ask Ss if this is correct? Have a S make corrections if necessary.

B. 1. Introduce shells.
Identify - discuss where they are found, animals that used to live in them, etc. Name each type.
2. Ask Ss if some look just alike, just the same?
3. Place 4 boxes on table. Have all Ss put the shells in each box that are just the same, just alike, etc.
4. Empty boxes. Mix the shells. Ask a S to put the shells together that are just the same.
5. Remove boxes. Hold up a snail and a scallop. Ask Ss how are they different? Probe and suggest ways after Ss have exhausted possibilities.
6. Hold up a snail and a conch. Ask Ss how they are the same or different. Probe and suggest if necessary.

C. 1. Place all shells and buttons on the table. Place two boxes on table.
2. Tell Ss - "I have 2 boxes. I want to put all the things in these two boxes. I want one kind in this box and another kind in this box. How can we do this?" Probe, reward, until Ss understand what their task is. Have Ss place correct objects in each box.

Session II

Materials: 4 boxes; 5 nuts, 5 bolts, 5 washers, 5 nails, (each group identical in size, shape and color); 5 pecans, 5 peanuts, 5 walnuts, 5 almonds, 5 buckeyes.

A. 1. Introduce hardware.

a. Identify - place one of each group in sight of Ss; name each object; discuss their use.
b. Multiple labeling for each object. Discuss with Ss their shape, markings, by asking Ss, "What can you tell me about this bolt?" Let children give spontaneous answers. Suggest others; probe, e.g., color, size, what is it made of? These objects do not lend themselves to lengthy labeling. Do not spend too much time at this point on labeling.

2. Place all hardware on table. Ask Ss if some look just alike, or just the same. Have one S that answered question correctly show everyone two objects that are just the same.
3. Teacher sorts items together without the boxes, by shape, and places one wrong. Asks Ss if she is right. Have a S correct mistake.
4. Have a S mix all the hardware together. Place 4 boxes on table and ask Ss to put the ones together in a box that are just the same, just alike.

B. 1. Introduce nuts.
   a. Identify objects (one of each type), discuss what they are, where they are found, who eats them, where they grow.
   b. Multiple labeling - probe and suggest attributes for each nut, Do not labor over too many attributes for each nut.
2. Place all the nuts on the table. Ask Ss if some nuts look just the same or just alike. Have a S who answered correctly show the group two items that are just the same.
3. Place 4 boxes on the table. Ask one S to put the nuts in each box that are just the same. Ask another S if this is the right way.
4. Repeat previous procedure with another S.
5. Children make piles with mistakes for others to guess which are wrong.

Session III

Materials: 4 blue combs (2 large, 2 small), 4 pink combs (2 large, 2 small); 4 blue toothbrushes (2 large, 2 small), 4 pink toothbrushes (2 large, 2 small).

A. 1. Introduce combs.
   a. Identify 1 large blue comb, discuss its use - present 1 large pink comb. "Are they the same?"
   b. Find similarities and differences. "How are they the same? How are they different?"
2. Present all the combs. Find similarities and differences. Have S pick up the comb he is discussing.
3. Place 4 boxes on the table. Have Ss place the combs in each box that are just the same. Ask for justification.
4. Have a S empty all boxes. Place 2 boxes on the table and ask Ss if there is another way we can fill just two boxes so that all the combs in one box will be the same, all the combs in another box will be just the same. Have Ss carry out this task. The teacher will make suggestions if necessary.
5. Have a S empty boxes and repeat previous procedure.
6. Ask Ss if all the large combs are blue. Are all the pink combs small?

B. 1. Introduce 1 large pink toothbrush.
   a. Identify, discuss reason for its use, when a person should use it.
   b. Present all toothbrushes. Find similarities and differences. Have S pick up the object he is discussing.
2. Place 4 boxes on the table. Have Ss place all the brushes that are just the same in each box. Ask for justification.

3. Have a S empty all boxes. Place 2 boxes on the table. Explain to Ss that you are going to put the brushes together that are the same in this box and those brushes that are the same in this box. Sort the objects on the basis of color and place one item incorrectly. Ask Ss if this is the right way. Why?
4. Have S empty boxes and ask that S if he can think of another way we can put the objects so that they are just alike in this box and just alike in the other box. Why?

C. Present all combs and all toothbrushes.
   1. Place 2 boxes on table. Ask Ss for one dichotomy. Why?
   2. Pose question for second dichotomy - Why?
   3. Empty both boxes. Ask Ss if everything blue on the table are combs? If all of the toothbrushes are pink? Why?

Session IV

Materials: Complete set of shells, nuts, combs, hardware.

1. Present each set of objects, have Ss label each set, explain function of each set.
2. Have a S mix all objects. Ask Ss if they can put together the things that go together (without boxes).
3. Play a guessing game. The teacher is thinking of some things that are made of metal, that are found near water, that working men and daddies use, of something that helps you look nice, of something to eat, etc.
4. Pose question. "How are they all alike in one way?" e.g., (Hard, will not bend).
5. Place set of hardware, combs, and nuts in center of table. Ask one S if he can put the things together that go together. Ask Ss if he is right. Repeat procedure until each S has a turn, but vary groups of objects used.

Session VI

Materials: plastic car, metal car, metal dump truck, plastic fire truck.

A. Introduce plastic car.
   Multiple labeling - "What can you tell me about this car?" Let children give spontaneous answers. Suggest others when they finish; or probe. For example, color, size, what is it made of, wheels, people ride in it, steering wheels, adult drives it, has seats, windows, etc.

B. Introduce metal truck.
   1. Multiple labeling - probe and suggest.
   2. Find similarities and differences with the car. "Are they the same? How are they the same? How are they different?"

C. Introduce metal car.
   1. Multiple labeling
   2. Compare similarities and differences with truck.

D. Introduce plastic fire engine.
   1. Multiple labeling
   2. Similarities and differences.

E. Are they all alike in some way? Is there a name for all of them?

F. Teacher groups 2 objects that are alike in some obvious way and poses question - "Can you tell me one way these two are alike and not the others?" For example, color, substance, etc.

G. Repeat with mail truck and fire engine.

H. Repeat with plastic car and plastic fire engine.

Session V

Materials: Apple, banana, pear, orange, tangerine, lemon.

A. Introduce orange.
   Multiple labeling - What can you tell me about this orange? What can you do with it? Probe and suggest. For example, color, shape, food, peel, eat it, sweet.

B. Introduce banana.
   1. Multiple labeling
   2. Compare similarities and differences with orange.

C. Introduce tangerine.
   1. Multiple labeling
   2. Compare similarities and differences with orange.

D. Introduce lemon.
   1. Multiple labeling
   2. Compare similarities and differences with orange and tangerine.

E. Introduce apple and pear.
   Compare similarities and differences.

F. Compare similarities and differences with apple and banana.

G. Pose question, "Is there something that you can call all of them?" Present idea of another food, cracker. "Would that be a fruit, too?" Why?

H. Teacher groups lemon and banana together. "How are these two alike?" (Peel, color, etc.)

I. Teacher groups apple and pear together. "How are these two alike?"

J. Pose question - "Can you find me two that are alike in color and shape?"

Session VII

Materials: Blue hat, brown leather glove, brown leather shoe, red rubber boot, red scarf, red shirt, blue tie.

A. Introduce all wearing things.
   1. Multiple labeling - "What can you call all of these things?" List attributes of each item, color, material, use, where do you wear it, does it keep you warm or dry?
   2. Compare similarities and differences with shoe and boot, tie and scarf.

B. Teacher suggests attributes of an object and each child has a turn in guessing which object it is.

C. Have each child choose two items that are alike and tell to group.

D. Teacher asks Ss if they can find two objects that are alike in two ways.

E. Play "teacher is wrong" game, name one item and list attributes with one wrong. Boot - is red, rubber, shiny, you can keep your foot dry, you wear it in the bathtub.

F. Have Ss name other items of clothing.

G. Class inclusion:
   1. Are there more red things or more clothes?
   2. Are there more things to wear around your neck or more clothing?

Session VIII

Materials: Clothing from previous session; Fruit from previous session.

A. Present clothing.

B. Play "teacher is wrong" game (E of above). "The glove is brown, leather, soft, and you wear it on your head."

C. Class inclusion:
Are there more things for your feet or more clothing?
Are there more things to wear around your neck or more clothing?

D. Introduce fruit.

E. Teacher sorts items together using color as single attribute, places one wrong, asks Ss if she is right.

F. Have Ss take turns in finding a single attribute and sort correct items.

G. Guessing game - Tell Ss you are thinking of something red and plastic. Let them guess what it is. Have Ss find another red and plastic object. For example, something hard and shiny, something soft and red, etc.

Session IX

Materials: 1 Negro family of 4; 1 white family of 4; 1 Negro fireman, 1 white policeman.

A. Present 1 Negro father. Multiple labeling - probe and suggest attributes.

B. Present policeman.
   1. Multiple labeling - probe and suggest attributes.
   2. Find similarities and differences with Negro father.

C. Place all rubber people on the table. "Are they all the same in some way?" "Is there a name for all of them?"

D. Teacher groups the two boys together and poses question - "Can you tell me one way these are just the same?" How are they different?

E. Teacher groups 2 fathers together, and fireman and policeman together - poses standard question.

F. Ask one S to find 2 people that are alike in some way. "Now can you find me another one?"

G. Play "teacher is wrong" game. Group the children together, add policeman. Ask Ss if this is the right way. Let Ss correct grouping.

H. Ask one S to group all the people together that are alike. Let other Ss correct - have each S repeat procedure.

I. Class Inclusion:
   1. Are there more daddies or people?
   2. Are there more people or children?

Session X

Materials: Family of 4; dishes (4 cups, plates, forks, spoons), toothbrushes (2 different sizes and colors); 2 boxes.

A. Introduce family of four.
   Multiple labeling. "What can you tell me about this family?" There are 4 people, they eat, sleep, run, play, etc.

B. Introduce set of dishes - multiple labeling.

C. Present family and other mixed materials. Ask a S to put the things together that go together.

D. With a comb and a boy - pose question, "Can this comb and this boy belong together in some way?" Why?

E. Introduce a small blue toothbrush.
   1. Multiple labeling - probe and suggest
   2. Present large pink toothbrush. Find similarities and differences.

F. Place all brushes on table and have a S put those brushes together that are just alike. Have Ss check correctness of groupings.

G. Place two boxes on the table and have S find a way of putting the things together that go together another way.

H. With the same two boxes, ask a S to find another way of putting the brushes together.

I. Place a mother and large blue toothbrush in center of table. Ask Ss if they belong together in some way.

Session XI

Materials: set of erasers; set of nuts; 12 inch x 12 inch cloth, set of keys.

A. Introduce erasers.
Multiple labeling of entire set - "What are they? What color are they? What do we do with them? Where do they come from, etc."

B. Introduce set of keys.
   1. Multiple labeling
   2. Compare similarities and differences with two different objects.

C. Place all objects, mixed, in center of table. Play "teacher is wrong" game - tell Ss that you are going to put the objects together that go together. Fail to place 3 items in correct groups. Let Ss find mistakes and physically correct task.

H. Have a S mix both sets together. Have same S put the things together that go together.

I. Play a guessing game. Place 4 objects from keys group, 1 eraser in center of table. Tell Ss to look very closely. Place cloth over objects and remove eraser. Remove cloth and have Ss guess which one you have removed.

J. Repeat procedure 3 times - Each time with a different set with four of a kind, one different. Always remove the differing one. Let Ss take turns in guessing. After the third time ask Ss if they can tell which one you are going to remove before you take it away. Repeat procedure until they understand object of game or before novelty wears off.

Session XII

Materials: Set of farm animals, set of dinosaurs, set of buttons, set of safety pins in 4 sizes.

A. Introduce dinosaurs.
   1. Multiple labeling
   2. Compare similarities and differences.

B. Introduce Farm animals - ascertain similarities and differences: in item itself, function, the animal (such as what they eat).

C. Place farm animals and dinosaurs in group "What do we call all these things?"
   1. More animals than dinosaurs.
   2. More dinosaurs than animals (as in standard class inclusion question).

D. Introduce safety pins.
   1. Multiple labeling.
   2. Similarities and differences - largest and smallest.

E. Place buttons with pins - group according to similarities. Name for all these (fasteners) - functional similarity.

F. Sort all groups on table into two sets - animals and fastening things.

APPENDIX B

SERIATION TRAINING SESSIONS

These twelve training sessions follow this sequence:

1. Comparison between two sizes
2. Relative Comparison
3. Serial Correspondence
4. Multiple seriation

Each material is approached first in its descending order whether its relation is height, width, or shades of color. Training the group of children to seriate in ascending order is contingent on the groups' mastery of the previous skill. Whenever possible a child is called upon to initiate any corrections. To retain the interest of the children, a game-like atmosphere will prevail. Verbal reinforcement will be given to a correct response.

These sessions were based on data from the Ypsilanti Early Education Program presently in operation and from the Preschool Curriculum Development Project by Hooper and Marshall, 1968.

Materials:

1. 3 bowls, differing 2 inches in width
2. 4 pitchers, differing 2 inches in height and width
3. 10 green circles, differing 1/2 inch in diameter
4. 10 cylinders, differing 1 inch in height
5. 8 cylinders, differing 1/2 inch in diameter
6. 6 nesting barrels, differing 1/2 inch in height and width
7. 5 three inch squares, differing in shades of blue.
8. 2 sets of size grades objects, 5 squirrels, 5 trees, differing in width and 1 inch in length
9. 10 green felt, Easter eggs differing 1/2 inch in length

10. 2 sets of size graded objects, 5 sails, 5 boats, differing 1/2 inch in length.

11. 2 sets of size graded objects, 7 houses, 7 dogs, differing in width and 1/2 inch in length.

12. 5 hats, differing in shades of blue and 1/2 inch in length.

13. 10 tepees, differing 1 inch in height.

14. 10 paper glasses of milk, differing 1/2 inch in length.

15. 5 paper glasses of juice, differing in shades of red and 1/2 inch in length.

16. 7 felt-model children,differing 1/2 inch in length.

17. 7 baskets, differing 1/2 inch in width and height.

Session I

Materials: 3 bowls; 4 pitchers.

1. Introduce 2 bowls of obvious size difference.
   a. Comparison between two bowls. "Can you tell me which one is the biggest, smallest?"
   b. Introduce middle size bowl. Compare it to the smallest. "Is this bowl smaller or bigger than this one?"
   c. Compare middle bowl with largest bowl. "Is this bowl smaller or bigger than this one?"
   d. Ask one child - "Remember the story of Goldilocks and the three bears? These bowls look like they belong to Papa bear, Mama bear and Baby bear. Could you put them on the table for the three bears? First, the biggest for Papa bear, the next biggest for Mama bear and then the smallest one for Baby bear."
   e. Let each child have a turn. Repeat with each child - the biggest, the next biggest and the smallest one for Baby bear.

2. Introduce two pitchers of obvious size difference. "What are these?"
   a. Compare two pitchers. "Can you tell me which one is the biggest, smallest?"
   b. Introduce middle size pitchers. Compare with smallest, largest.
   c. Ask one child - "If you were a Mother and were putting these pitchers away on the shelf, show me how you would put the biggest, next biggest and smallest."

   For boy Ss - "If you were a man working in the service station, etc."

3. Introduce fourth size pitcher. "Look I have another pitcher, where shall we put this one on the shelf. Why?"

4. Teacher lines them up the wrong way and asks Ss if that is the right way. Let the Ss correct mistake. Repeat.

5. Have each child take a turn in seriating pitchers. Repeat biggest, the next biggest and the smallest one, if necessary.

Session II

Materials: 4 circles, 5 cylinders (height); 4 cylinders (width).

1. Introduce three green circles - "What are these?"
   a. Ask a child to seriate - "Let's play these are balloons. One for Papa bear, one for Mama bear, one for Baby bear. Can you pretend you are giving one balloon to each bear? Give one to Papa bear first, etc." Repeat after child has completed task. "Yes, you gave one to Papa bear, etc."
   b. Introduce fourth circle - "Look here's another balloon. Is it the biggest one? Smallest? Where should we put this balloon? Perhaps this is Grandfather's balloon."
   c. Have two Ss seriate circles. The other Ss will check their work. Have other Ss complete task also.

2. Introduce four cylinders differing in width only. "What are these? How are they different?"
   a. Can you find me the largest? Next largest? Next largest? Smallest?
   b. Divide the group. Ask one group to place cylinders from the largest to the smallest. Have second group decide if task is correct. Scramble objects, let second group place objects in correct order.

3. Introduce three cylinders differing in height only. "What are these? How are they different?"
   a. Ask one child to place them in the right order from largest to smallest. Ask group if it is correct.
   b. Introduce fourth cylinder. Ask Ss where this one belongs.
   c. Introduce fifth cylinder (next to largest.) Teacher places this one incorrectly. Asks Ss if this is the right way. Why? Let Ss place cylinder in correct place.
   d. Ask one S to scramble cylinders and place them in the right order. Have each child take a turn.

Session III

Materials: 5 shades of blue; 6 barrels; 7 cylinders (height).

1. Introduce three shades of blue. "What are these?"
   a. "Can you find me the darkest? Next darkest? Lightest?"
   b. Divide group. Ask one group to place them in order from darkest to lightest. Have other group check. Scramble them. Ask other group to repeat task.
   c. "Here is another shade of blue. Where do you think it belongs? Why?"
   d. "There is one more shade of blue. Where shall we place this one? Why?"
   e. Scramble objects. Have each child seriate shades of blue, calling on other Ss to correct if necessary.

2. Introduce barrels. "What are these? You have used these before."
   a. Have a S show how we have used these before.
   b. Remove from nesting position. "There is another way we can use these." Place the first, third, and fifth barrel in order.
   c. "Can you find me the largest barrel? Next largest? Smallest?"
   d. Present the remaining two barrels. "Where do you think we should put these barrels so they will be in just the right place?"
   e. Have a S mix the objects. Have each S seriate barrels, always having other Ss correct if necessary.

3. Present 5 cylinders - Have a S seriate.
   a. Present sixth cylinder - "Where shall we place this one?"
   b. Scramble - Have 2 S's seriate.
   c. Present 7th cylinder. Repeat b.
   d. Scramble - Let each S have a turn ordering objects.

Session IV

Materials: All previous materials.

1. Introduce bowls with reference to Papa bear, etc.
   a. Let S be teacher. Encourage S to ask for largest, next largest, smallest. Have S ask a child how can we place these bowls in order. Let S check.

2. Present four pitchers.
   a. Teacher places pitchers in wrong order. Asks Ss if this is the right way. Why? Have Ss place them in correct order.

3. Present circles (7).
   a. Have S place in correct order. Ask Ss if correct.
      b. Present fifth circle (fourth in series). Ask Ss where can we place this one? Why?

4. Present five shades of blue. Have S place in order. Ask Ss if he is correct.

5. Present 8 cylinders differing in height.
   a. Have S place them in order.
   b. Present fifth (second in series). Ask Ss where this one should go. Why?

6. Present 6 cylinders differing in width.
   a. Have S place in order.
   b. Present fifth cylinder, the largest, ask Ss where this one belongs. Why?

Session V

Materials: 8 cylinders; 5 squirrels; 5 trees; 5 circles.

1. Introduce 4 cylinders. "How are these different?"
   a. Divide group. Ask one group to place cylinders from the largest to the smallest. Have second group decide if task is correct. Scramble objects, let second group place objects in correct order.

b. Introduce remaining 3 objects. "Where shall we place these, so they will be in just the right order. Each one has a very special place."
c. Have a S scramble objects and seriate all cylinders. Have other Ss help if necessary.
d. Play catch the teacher in a mistake. Teacher seriates objects, places one incorrectly. Have a S correct. Repeat with 2 items in incorrect order.

2. Introduce a squirrel and corresponding tree.
   a. Identify and discuss; squirrels have their homes in trees, what do squirrels eat, where do they find nuts? etc.
   b. "But we have 5 squirrels and 5 trees. We will have to find each squirrel his very own tree." Place the trees in the center of the table alone. Divide group. Ask one group to place them in order from the largest to the smallest. Have other group correct.
   c. Place squirrels in center of table. Have second group place squirrels in order.
   d. Ask Ss, "Can you think of a way to find each squirrel his very own tree?" Probe and suggest if necessary.
   e. Scramble objects. Ask Ss if they can find a way to place each squirrel in his very own tree. Show them if necessary by asking them to put first the trees together, then which is the largest tree, etc. Repeat with squirrels.
   f. If this task is difficult, scramble objects and repeat.

3. Introduce 5 balloons.
   a. Suggest the squirrels will now have a birthday party and these circles are their balloons.
   b. Repeat procedure used with squirrels and trees.

Session VI

Materials: 10 Easter eggs, 5 sails, 5 boats, 9 green cylinders, 5 squirrels.

1. Introduce 5 Easter eggs "How are they different?" "What could we pretend these are?" Discuss color, shape, etc.
   a. Ask one S to place them in order from largest to smallest. Ask group if it is correct.
   b. Present a sixth egg. Ask Ss where this one belongs.
   c. Present seventh egg. Teacher places this one incorrectly. Asks S if this is the right way? Why? Let Ss place in correct order.
   d. Ask one S to scramble objects and place them in the right order. Have each child take a turn.

2. Introduce a sail and a boat. "What is this? Where do we find boats? Have you ever been in a boat? etc."
   a. We have 5 sails and 5 boats. Each boat has its own sail. Can you think of a way we can find the right sail for each boat? Refer to how every squirrel found his tree. Repeat sequence as with squirrels and trees.
   b. Repeat procedure for each S to have a turn.

3. Introduce green cylinders.
   a. "Let's make a stairway for our squirrels to climb." Let each S have a turn. Let Ss playfully have their squirrel climb the stair.
   b. Present 6th cylinder, 7th cylinder. Have a S place in order.
   c. Present 8th cylinder, 9th cylinder. Repeat b.
   d. Scramble. Let each S seriate.

Session VI

Materials: 4 pitchers, 8 green circles, 5 squirrels, 5 trees, 8 cylinders differing in width.

1. Introduce 4 pitchers.
   a. Can you find me the largest? Next largest? Next largest? Smallest? As Ss pick up each pitcher, teacher places them in correct order.
   b. Scramble objects. Teacher lines up objects incorrectly and asks Ss if that is the right way. Let Ss correct mistake. Repeat.
   c. Place 3 pitchers in random order. Have one S seriate. Present fourth pitcher and have the S insert correctly. Repeat for Ss that need this foundation.

2. Introduce 5 circles. "Here are these balloons again. Now there are more" Have Ss count.
   a. Can you find me the largest? Smallest?
   b. Ask a S to place them in correct order. "There is going to be a birthday party and we want the balloons to be in just the right places."
   c. "We are having two more children come to our party. Where shall we put these balloons so they will be in just the right place?"
   d. Scramble. Refer to balloons floating all around. Now they have landed on the table and we must put them in just the right places again.

3. Introduce 5 squirrels and 5 trees in random order.
   a. Make up a story about the squirrels out finding nuts for their supper. They want to find their very own tree again. Ask a S if he can find the squirrels their homes. If no response, repeat previous sequence of placing them in order. If group responds readily, repeat procedure, giving each child a turn.

4. Introduce 5 cylinders.
   a. Do you remember these? How are they different?
   b. Which one is the largest? Which one is the next largest? etc. Teacher places them in order as Ss pick up correct one.
   c. Scramble. Have each S seriate.

Session VII

Materials: 7 houses, 7 dogs, 10 Easter eggs, 6 barrels.

1. Introduce 4 houses in random order discuss features.

a. Ask a S to find the largest house, smallest house; ask a S to finish building this street of houses, so that each one is in just the right place.
b. Present another house. Have a S find where this house belongs.
c. Present another house. Repeat b.
d. Repeat c.
e. Scramble houses. Divide group. Have one group seriate items. Repeat with second group.

2. Introduce 7 dogs. Explain to Ss that in each house lives a dog. These dogs have all been out to play and now they must find their very own home. Ask Ss if they know of a way to find each dog a house.
   a. If no response, repeat sequence as with squirrels and trees. Otherwise, have Ss working together to find correct order.
   b. "Now the dogs want to run out to play again." Separate dogs from houses. Ask a S to find correct order again, continuing with story.

3. Introduce 5 eggs.
   a. Have Ss place in order. Scramble - rearrange, providing Ss with playful discussion about the eggs.
   b. Present remaining 5 eggs, one at a time, having a S take turns placing in order.
   c. Play teacher makes a mistake, giving each S a turn in finding the mistake.
   d. Take 5 smallest eggs and suggest that each dog has his very own egg. Have a S perform task.
   e. If Ss are receptive, place 2 more eggs and dogs for them to work with.

4. Present 4 barrels as cans of dog food.
   a. Have a S arrange in order. Stress largest, next largest, etc.
   b. Present 2 more barrels. Have a S seriate.
   c. Present 6 dogs. Have each S find a can of dog food for each dog.

Session IX

Materials: 10 Easter eggs, 5 squirrels, 10 tepees, 10 glasses of milk and 5 blue hats.

1. Introduce 7 easter eggs. Discuss color. "How are they different?"
   a. Teacher lines them up the wrong way and asks Ss if that is the right way. Let Ss correct mistake.
   b. Repeat procedure. Ask one S if the order is correct. Have that S correct seriation.
   c. Present another egg. Explain to Ss that this one has a very special place and ask one S if he can put this in just the right place.
   d. Repeat procedure with ninth egg, tenth egg.

2. Present 5 eggs, 5 squirrels.
   a. "These little squirrels each has his very own Easter egg. See if you can find each squirrel his egg."
   b. Scramble, let each S have a turn.

3. Introduce 7 glasses of milk in random order. Tell Ss that a little boy is going to have a birthday party and they should put all the glasses of milk on the table, but they look messy that way. "Is there a way we could put them in order so they will look better?" If no response suggest they find the largest glass, the next largest, etc.
   a. Have a child scramble the glasses. Let that S play teacher and show others how to place the glasses so each glass has a special place.
   b. Present eighth glass. Tell Ss that another child has come to the party and ask Ss where we should place his glass.
   c. Present ninth glass. "Here comes another child to the party. Where must we place his glass?"
   d. Present tenth glass. "This child is really late. There may not be any birthday cake left for him. Where shall we place his glass of milk?"

4. Introduce 10 tepees. What are these? Discuss. Tell a brief story about Indians and tepees.
   a. Have Ss arrange in order.
   b. Suggest that they might find the right order by beginning with the smallest. Try to have each S verbalize his actions, e.g., the fact that now he is finding the smallest object from the remaining group of unordered objects.

5. Introduce 3 blue hats. "How are these different?"
   a. "Can you find me the darkest, the next darkest, the lightest?"
   b. Repeat with size difference.
   c. "Here are two more hats" Have a S place in order.
   d. Scramble and have Ss arrange. Have each S take a turn.

Session X

Materials: 6 barrels; 5 paper glasses of juice; 7 houses; 7 dogs, and 10 green cylinders.

1. Introduce 6 barrels. Discuss what they are and ask Ss, "What can we do with these?"
   a. Have a S operate nesting task. Have others correct.
   b. Pose question - "What else can we do with these barrels?" Have another S place barrels in order.
   c. After task is completed, ask a S to point to the largest one, another S point to the smallest one. Verbally reinforce - "Yes, this is the largest.", etc.

2. Introduce 5 glasses of juice in random order. "What kind of juice could be in these glasses?"
   a. Comment on juice time at school. Suggest to Ss that they should be placed just right on the table, for each glass has its very own place. Have a subject complete task.
   b. Play teacher makes a mistake game - place them in a disorderly arrangement. Ask a S if this is the right way. Why? Have that S arrange them in order.
   c. Repeat procedure until each S has a turn.

3. Introduce 7 houses and 7 dogs. Explain that these little dogs are lost. Each dog has his very own house.
   a. Ask a S if he knows a way to help the dogs find his very own home. If no response, repeat sequential steps for the Ss to see how the dogs find their homes.
   b. After dogs are in their homes, tell Ss that now the dogs would like to go out to play. Have a S help them find their homes again.
   c. Repeat sequence with different stories until each S has a turn.

4. Introduce 10 cylinders
   a. "Remember how we made a stairway for our animals to climb?" Have Ss take turns performing the task. If possible have them verbalize the operation they use, beginning with the smallest or largest.
   b. Have Ss cover their eyes. Remove a cylinder. Let each S have a turn in replacing a cylinder into the stairway.

Session XI

Materials: 10 green circles; 5 squirrels, 5 trees, 10 tepees, 7 felt-model children.

1. Introduce 7 children. "Now we can really have a birthday party, we have some children. How are they different?"
   a. Present 7 balloons. Have Ss take turns finding a balloon for each child.

2. Present 10 circles as balloons. Have Ss pretend they are balls. Ask each S to place these balls on the shelf in a store. Help Ss verbalize their actions, choosing largest or smallest to begin task.

3. Introduce 5 children, 5 squirrels. "Now each child can have his very own pet."
   a. Let each S have a turn finding each child his very own pet.
   b. Place 5 trees on table. Have pets run back to their very own home in a tree. Have Ss perform this task.

4. Introduce 10 tepees. "Do you remember who lives in these?" Discuss. Have each S place in order. Help S verbalize this action.

Session XII

Materials: 7 baskets, 10 Easter eggs; 5 glasses of juice; 5 boats; 5 children; 10 cylinders (height).

1. Introduce 7 baskets. Discuss. How are they different?
   a. "Can you find me the largest, smallest?"
   b. Have each S place in order. Help Ss to verbalize their actions.

2. Present 7 eggs. Discuss
   a. Ask Ss to find just the right egg for each basket. Scramble, rearrange
   b. Remove baskets, add 3 more eggs. Have Ss place these eggs in order.
   c. Have Ss cover eyes. Let each S have a turn in placing an egg back into the arrangement, that the teacher has removed.

3. Introduce glasses of juice. "How are these different?"
   a. "Can you find me the darkest and the largest? The lightest and the smallest?"
   b. Have each S place objects in order.

4. Introduce 5 boats, 5 children. "Our children haven't taken a boat ride yet." Provide a brief story for interest.
   a. Have each S find each child his very own boat.

5. Introduce 10 cylinders.
   a. "Let's make a stairway for our children to climb." Let each S have a turn.

APPENDIX C

MEMORY-DISCRIMINATION TRAINING SESSIONS

The purpose of these sessions is to facilitate the children's ability to remember a sequence of actions, to establish their memory for details, and to verbally express these abilities. The training of these abilities is in keeping with Watson's contention that memory for details and sequences of actions are essential to the ability to pass Piaget's conservation tasks.

Session 1: Motor imitation ("Copy cat game")

Format: The children sit in a circle with the E. E presents a series of gross movements; Ss must reproduce movements in correct sequence.

1. Copy cat game using one arm.
   a. Single arm movements
   1) Flex elbow; touch shoulder; arm up
   2) Tap head, circle arm out front; touch nose; drop arm to side.
   3) Ask children to make up a series for others to copy.

2. Double arm movements in copy cat game.
   a. Both arms extended to sides; clap hands; swing arms by side.
   b. Rotary arm movements at sides; touch shoulders; arms over head; drop arms bv side.
   c. Ask one subject to make up double arm series for others to copy.

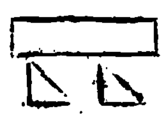
3. Trunk movements in copy cat game.
   a. Hands on hips; bend at waist to left; jump
   b. Turn around; bend forward at waist; stand; cover mouth with two hands
   c. Ask children to make up a series for others to copy.

4. Statue game: E does series of movements and says stop; E holds position and Ss try to reproduce series.

Session 2: Block games:

Format: Children sit with E at a table.
E makes a design using the blocks and Ss copy the end-product of the design
E makes a design and Ss copy sequence of design building as well as the end-product.

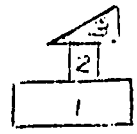
1. Simple design, flat on surface
   a. E makes design.

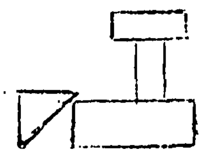
   b. Each S copies design only.

2. Simple design and movements
   a. E makes design in this sequence.

b. Directions: "Watch how I build this; watch which block comes first, then second, then third and the last one." (destroy model.)

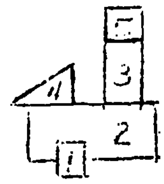


3. Complex design
   a. E makes:



   b. Each S copies design only

4. Complex design and movements
   a. E makes design in number sequence.



   b. E destroys model.

   c. Ss build model as a group.

5. Continue as time permits.

Session 3: Commands ("Message Game"):

Format: Subjects sit in circle with E.
Repeat a few sequences of the "copy cat game" asking the children to make up sequences of movements.

E gives series of verbal commands; one S tries to reproduce sequence; other Ss check his accuracy.

1. E does two things; Ss tell what E did verbally.

2. Two commands (no demonstration----just tell).
   a. blink your eyes, tap your toes.
   b. run to the corner, then clap your hands.
   c. choose one S to give two commands----either to other S, or whole group.

3. Three commands.
   a. First go to the door, hop once, then open the door.
   b. Put this block in that corner; turn around in the corner, and come back to me.

4. Four commands.
   a. Put this penny on the table; bark like a dog; touch the scales (or run around the circle); and sit at the table.
   b. Pick up the pencil; go touch the doorknob; give me the pencil; and tell us your name.

5. Have each S think up a series of two commands, or three if they can; have them whisper it to E first to check whether feasible.

Session 4: Review

Repeat a series of block sequence trials, having the children copy them.

Session 5: Visual memory and analysis:

Format: Present picture; Ss label items in it; hide picture; Ss recall items.

1. Family scene picture.
    a. Have Ss label as many items in picture as they can; suggest ones they miss.
    b. Hide picture: "Now, this is the game...how many things can you remember in that picture? Tell me everything you remember."
    c. Return picutre and check accuracy; point out omissions.
    d. Hide picture; have Ss tell a story about the picture.

2. Magazine sheets of scenes and items.
    a. Label each item; on some talk about them.
    b. Hide sheet.
    c. Ss recall items.
    d. Check accuracy; omissions noted.

3. Magazine sheets of scenes and items.
    a. Show sheet for several minutes: NO labeling or talking.
    b. Hide sheet.
    c. Ss recall items; check accuracy.

Session 6: Review and verbal memory game:

1. Repeat picture items from memory without previous labeling.

2. Verbal memory game: Say out loud several items and have Ss remember them in sequence.

    a. mud-pencil-orange juice-car
    b. moon-birthday-blackboard-snow.

Session 7: Picture arrangement ("Make a picture story"):

Format: Children sit at a table with the E.

Present pictures one at a time in jumbled order for Ss to talk about; lay all on the table mixed up; have Ss put pictures in sequence to make a story; have other Ss check it.

1. Block building story - four parts - boy on slide.
2. Colored picture stories - four parts - fire engine sequence.
3. Colored picture stories - four parts - milk story sequence.

Session 8: Review:

Format: Subjects sit at the table with E.

Repeat: picture sequence arrangements.
1. Hospital sequence - colored picture stories - four parts.
2. Mail sequence - colored picture stories - four parts.
3. Supermarket sequence - colored picture stories - four parts.

Session 9: Story reading and questions:

Repeat: Pictures from memory - large colored animal pictures - no talking is permitted until pictures are hidden.

Read story: Brown Bear, What Do You See?

Check on memory for details -- get spontaneous recall; then elicit other details.

Session 10: Story Reading Review:

Format: Children seated in circle while E reads story. Get spontaneous recall; then elicit other details by asking about events or objects in the story. If interest and time permit, allow Ss to recreate parts of the story from memory.

Session 11: Review:

Format: Subjects sit in a circle with E.

Repeat stories from memory for details:
1. Brown Bear, What Do You See?
2. The Very Little Boy
3. Madeline

Repeat: Sequence picture, to see they remember the correct order.
1. Fire Engine Sequence
2. Hospital Sequence

Session 12:

Format: Children sit in circle with E, who uses a number of items from previous sessions to help to consolidate skills:

1. Copy Cat Game.
   a. Arm movements: hands on knees; arms out straight and wiggle fingers; cross arms at waist.
   b. Trunk movements: turn around; touch one elbow; cover eyes; sit down.

2. Message game.
   a. 3 commands: go to door; sit on that chair; and bring me the pen.
   b. 4 commands: put this pen on that chair; say, "the pen is on the chair"; bring the pen to me; go to the door.

3. Visual memory
   a. Use picture sheets for Ss to look at without labeling; hide picture; have Ss recall as many items as possible.
   b. Have children make up stories about pictures.

4. Show and Tell using children's own clothing and items they have brought with them.