A COMPARISON OF SELECTED THOUGHT PROCESSES USED BY THREE- AND FIVE-YEAR-OLD CHILDREN

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CHAPTER I

INTRODUCTION

A child's adjustment to life is influenced by his understanding of environment, people, and self. Understanding is based on concepts which change with experience and the accumulation of knowledge. Dewey (1933) states that concepts arise from the significance of one's experiences and transfer to other experiences with the result that an anticipation of what behavior is characteristic may be derived from past experiences. Concepts grow more definitive as they are applied.

Early childhood is considered to be a very important period in the development of an individual's cognitive abilities. In the past decade interest in and investigation of the cognitive processes--the means by which organisms achieve, retain and transform information--have increased notably (Bruner, Goodnow and Austin, 1956).

Considerable current interest in conceptual development has been stimulated by the works of Piaget (1929, 1948, 1951, 1952), who suggested that distinct stages of growth exist with regard to the development of all intellectual abilities. For Piaget, the unfolding of various forms of conservation illuminate the child's cognitive development. Gesell (1949) also suggested that conceptual development follows a common, but individual pattern of growth. This general pattern of development may be more readily observed in groups of

children of different age levels than in any individual child. Both positions are supported by Curti's (1950) conclusions that research concerning conceptual development demonstrates that concepts are not acquired one after another. Instead, concepts develop through many experiences and formulate gradually through the use of a variety of cognitive processes. A child learns to think by organizing, interpreting and categorizing his understandings into some logical conceptual framework (Wann, Dorn and Liddle, 1962). As a child sees, feels, smells, hears, and tastes he has sensory impressions. Without depending on memory these impressions are called percepts. When the child begins to label and organize these sensory impressions into a framework, he is forming concepts (Russell, 1956). The child needs to begin to discriminate and differentiate the things in his environment. He needs to distinguish differences and similarities in size, weight, texture and shape. In early childhood education programs, observation skills are emphasized in order that the child can make the differentiations so necessary to conceptualization (Hymes, 1968). The child needs language to help him categorize and classify his ideas. Concept formation and language development are closely related (Piaget, 1926). Concepts are formed in the child's mind through language development. Words reflect concepts only when the child can use them to classify, combine, and categorize meaningful ideas. These concepts form a framework into which the child has placed past experiences and can add new experiences and give him a basis for understanding and interpreting new information and experiences (Wann, Dorn, and Liddle, 1962). Unless children are exposed continuously to intellectually productive learning activities during preschool and primary school programs, they tend to regress,

thereby minimizing the cognitive gains achieved (Sigel and Hooper, 1968).

Certain investigators have hypothesized hierarchies in the development of thought processes which lead to concept formation (Sigel and Hooper, 1968; Gordon, 1962). Welch and Long (Long, 1941; Welch, 1940, 1947; Welch and Long, 1940, 1943) have contributed a series of studies emphasizing the hierarchy of relationships involved in the development of children's concepts. These authors contended that cognitive skills organize themselves into hierarchies. Burt (1949) postulated a hierarchy of mental abilities involved in the development of thought processes, the highest of which is rational reasoning.

Educators and parents generally agree that children need to learn how to think. Yet research has indicated that many children have not been provided frequent and consistent opportunities to develop basic intellectual skills during their early years (Almy, 1966). Without knowledgeable teachers and other adults who have the necessary skills to provide learning activities that foster intellectual growth, these children experience great difficulty, frustration, and, too often, failure in the school situation (Sigel and Hooper, 1968).

Sigel and Hooper (1968) and Gordon (1962) have found that the skill of the teacher is a major factor in the development of initial cognitive skills in children. It is extremely important that adults be aware of the ways in which children acquire intellectual abilities and help children develop foundation skills in thinking. Sigel, Gordon, and Taba (1972) have suggested a hierarchy of cognitive skills which are essential for the child to develop in order to function

effectively in school and society.

A review of the literature suggests a lack of agreement about the specific processes involved in conceptual development and a lack of application of such information to curriculum planning. The investigator believes that further means of recognizing the operation of certain cognitive processes among young children and further information regarding any expected order or time in which the processes may be developing should be of value to teachers who wish to develop skills which will encourage cognitive development in children. The purpose of this study is to develop an instrument and use it to investigate and explore the thought processes of three- and five-year-old children and to determine whether these particular processes can be identified in a testing situation and whether variables of age and sex will be significantly related to the strength and acquisition of these particular cognitive skills.

The following hypotheses were examined:

I. There is no significant difference among total scores on the Schedule of Selected Thought Processes (SSTP) according to age or sex.

II. There is no significant difference among the scores on each sub-test (Items 1 through 8) of the SSTP.

   A. On Item #1 (observing) there is no difference among scores according to age or sex.

   B. On Item #2 (recognizing similarities and differences) there is no difference according to age or sex on:

      1. Complete scores for item.

      2. Comparison of scores for similarities and scores for differences.

3. Recognition of differences in object, color, or shape.

C. On Item #3 (ordering by age) there is no difference according to age or sex on:

1. Complete scores for item.
2. Ability to identify "youngest", "oldest", and order of development for chick and for person.

D. On Item #4 (classifying) there is no difference according to age or sex on:

1. Complete scores for item.
2. Level of verbal response.
3. Style of categorization.

E. On Item #5 (differentiating between critical and optional attributes of objects) there is no difference among scores according to age or sex.

F. On Item #6 (inferring cause-effect and feelings) there is no difference among scores according to age or sex.

G. On Item #7 (making appropriate choices) there is no difference among scores according to age or sex.

H. On Item #8 (recalling) there is no difference among scores according to age or sex.

III. There is no hierarchy of development of thought processes as measured by average scores on sub-tests or by differences between average scores for three-year-olds and five-year-olds.

CHAPTER II

RELATED LITERATURE

Children's thinking is usually influenced by certain factors such as the environment in which the child finds himself, the extent to which he is confronted with an explicit problem, and the sort of child, in terms of maturity and personality, who is doing the thinking (Russell, 1956). Thinking is a process rather than a fixed state. It involves a sequence of ideas moving from some beginning, through some sort of pattern of relationships, to some goal or conclusion (Almy, 1966).

Concepts are the premises and foundation of thinking, they are among the most important materials of children's thinking. Concepts often develop slowly out of percepts, memories, and images, and their development is aided greatly by language. Since each concept involves differentiation from other unlike ideas and appreciation of common relationships in members of the same class, the factor of insight may operate in concept development (Russell, 1956). Children seem to reach the generalization necessary for a concept through inductive thinking in which they have some help in discovering the generalization. They may also use deductive thinking in verifying or strengthening the structure of the concept (Woodworth, 1946).

In the mid 1800's Bartholomai conducted one of the earliest recorded studies of children's concepts. In this study 2,238 children entering first grade were questioned by their regular classroom teacher

as to their concepts regarding a series of topics. They reported that there was a notable vagueness of concept at this level. In 1891, G. Stanley Hall influenced by Bartholomai's work in Berlin, made one of the first studies of groups of American children using the questionnaire method to discover the content of children's minds.

Researchers have conducted empirical studies to determine the dimensions of concepts. Among the first laboratory experiments in the United States on concept formation were those of Hull (1920) and continued by other investigators, notably Heidbreder (1946). The general studies of Piaget conducted in the early twenties were important in the history of the study of concepts. A few specific concepts which have been studied are time (Ames, 1946; Springer, 1952), space (Ames, 1948; Piaget and Inhelder, 1948), number (Dodwell, 1960; Piaget, 1952), and class (Hazlitt, 1929; Piaget, 1951).

Studies of mental development of young children by Buhler (1935), Bayley (1933), and Gesell (1925; 1946) illustrate the complexity of mental development even at these ages. This complexity increases in older children. These studies suggest that there are "changes in the nature and organization of mental ability" accompanying changes in age.

Concerning the "stages" in the development of concepts, Curti (1950), has suggested that concepts grow gradually, but that four stages may be distinguished--the presymbolic stage, the stage of preverbal symbolic behavior, the stage of implicit general ideas, and the stage of explicit generalization. Curti indicates that with the gradual development of concepts there is a parallel development of attitudes. Karl Buhler (1930) did not use the term stages but he did

distinguish four general types of concepts that the child develops at different age levels.

Within the area of concept formation, several researchers have expressed an interest in the development of memories and the ability to recall. In memories children retain, recall, and relive past experiences. Memory, therefore, tends to operate in any of their activities in which they have had any previous experience. Its place in thinking may be observed in any child at almost any time. The child's learning depends upon his capacity to remember (Russell, 1956).

Children grow in their ability to recall details and complex patterns of situations as they develop other mental functions. Evidence of this ability can be noted almost from the time of birth. Munn (1946) summarized a number of studies to show that memory of delayed-action type, or simple recall, is present in the first year of life. As the child matures, his thinking and other behavior increasingly show that he is aware of past experiences and acts upon them in relation to present situations. In a study of the memories of children, aged two to five and one-half years, for the position of a cookie under a plate, Skalet (1931) found a positive relationship between age and the maximum time for correct placement. In selecting a figure seen previously from a random array of animal or geometrical figures the correlation between age and maximum correct delay was .67. The correlations indicate a high positive relationship between age and abilities in recall for preschool children. Pyle (1921) and Schwartz and Hurlock (1932) reviewed the findings about memory from thirty-six biographical studies of children. They conclude that as memory develops during childhood and adolescence, it becomes increasingly specific and accurate.

Memory is related to sex and to general intelligence as well as to age. In the preschool and school years girls have a slight advantage over boys of the same age in memorizing abilities, but the overlapping of their abilities is tremendous (Eysenck and Halsted, 1945).

In the development of space concepts, Ames and Learned (1948) found that the child goes through a looking, pointing, verbalizing sequence. Gesell and Ilg (1946) believed that there are marked individual differences among children but that there is a "relatively uniform age sequence" in the development of major concepts of space and time.

Other studies of children's concepts of size, shape, and position are included under space concepts. In a study of forty children aged two to five years Hicks and Stewart (1930) discovered that two-year-olds and many three-year-olds could not develop a concept of middle size in relation to three boxes of varying size. Thrum (1935) pointed out that children's abilities to note relative sizes are not the same as adult's abilities. She studied children's reactions to different sizes of cardboard squares, circles, and triangles at ages three to five years. She found that some children at three years have concepts of magnitude but that these are often inaccurate. The biggest object of a group is named most readily. By five years some children are capable of perceiving intermediacy. Using drawings of squares of three sizes, Graham (1944) found that a generalized concept of middleness increases between the ages of seven and nine years.

An important area in scientific concepts is the area of relational thinking, in terms of order, sequence, and cause. Scientific concepts may be said to develop slowly from immediate specific items to more

general measures of scientific nature (Russell, 1956).

Investigations of the thinking of young children have also been made by Grigsby (1932). He analyzed responses of eighty-three children aged two years and eight months to six years and four months, to six series of questions. Three of these were partitive (A part of the sand in the pile is wet. Is the sand wet?), causative (Why does a ball roll?), and discordant (Even though you do not like food, you....). In discordant and partitive relations, Grigsby believed that the child may understand the relation involved but not the hypothetical nature of the situation presented. The child's understanding of the relationship of the words used lagged behind his understanding of the individual words but increased with age.

Amen's (1941) study of the reactions of seventy-seven nursery-school children to ambiguous picture material showed changes in perception and conceptualization influenced by personal factors. The three major patterns of response or interpretation were (1) simple naming or identification--"a boy," "a lady," (2) description of picture in terms of overt activity--"This little girl is eating her breakfast," and (3) inference as to psychological states--"This little boy doesn't want to eat, but his mamma's going to get him to." According to Amen, the first interpretation was characteristic of the two-year-olds; the third one occured rarely at two years but was common at four years. Amen also analyzed the results as moving from the perception of concrete, often unrelated, details to recognition of these details as part of a larger whole.

A key component in the development of cognitive processes is skill at classification. Classification is the process by which people,

objects, and events are placed into categories and are responded to in terms of their class membership rather than on an individual basis (Snell, 1968). Classification behavior is viewed by Piaget and Inhelder (1964) as being comprised of successive stages with each stage being built upon the previous stages. Classification begins when two objects are grouped because they look alike in some manner (resemblance sorting). As the child matures, both the number of objects grouped and the number of characteristics used increases. The child begins to sort more than two objects (consistent sorting) and then includes all the objects which could be considered equivalent in some respect (exhaustive sorting). The child moves from sorting on observable attributes to grouping on the basis of unseen or inferred characteristics. In time the child recognizes that objects do not belong exclusively in different categories but can be members of many categories (multiple class membership). He actively tries out different groupings choosing first one then another single attribute as the focus for grouping (horizontal classification). As his logical abilities develop, his method of choosing criteria becomes more complex. He then chooses combinations of attributes to construct successive classes (Olmsted, Parks and Rickel, 1970; Kofsky, 1966).

Classification behaviors have been studied in terms of styles of categorization. Sigel and McBane (1967) define the "style" or "strategy" of classification as the individual's preference for particular basis for classification when he has been presented with items offering numerous criteria for grouping. Since all objects are multidimensional, an individual has a choice of the criteria he chooses as a basis for classification. Annett (1959) states that an individual's method of

classification is probably determined by a large number of factors including the subject's purpose in making the classification.

Three styles of classification have been identified and used in studies. These are descriptive, relational-contextual, and categorical-inferential styles (Sigel, Anderson, and Shapiro, 1966; Kagan, Moss and Sigel, 1963; Sigel and McBane, 1967; Sigel and Olmsted, 1969; Sigel, 1971; Sigel and Olmsted, 1970; and Hurt, 1970). Descriptive classification includes grouping by color, form, or structure. When asked to classify objects or geometric shapes that are comparable in color and form, children under six use color more often than older children (Corah and Gospodinoff, 1966; Corah, 1966; Mitler and Harris, 1969; and Modriski, 1969). Relational-contextual responses are made on the basis of use or thematic story. Grouping on the basis of function or class label is a categorical-inferential response. Allen (1971) found that boys used a significantly greater percentage of categorical responses than did the girls who used more relational-contextual responses.

The problem solving of young children must be considered as taking place in concrete, immediate situations rather than as occurring in abstract, verbal ones. Isaacs (1930) concludes that children as young as three do reason quite successfully when their interests are engaged. Heidbreder (1928) found that reasoning occurs at two-and-a-half years, and Hazlitt's (1929) finding indicated three years of age. But the reasoning is confined to concrete, personal, and immediate situations. Hazlitt believed that the ability to generalize and the ability to make exceptions can occur at all age levels studied--three to seven years. In regard to Piaget's theory of egocentrism, Hazlitt

believed that lack of experience makes the child unable to see relations and inability to see relations make him "egocentric."

McAndrew (1943) also questioned the validity of Piaget's stages in reasoning ability. In interviews with 151 children, aged three-years to six-years, she asked questions such as "What makes the trains go?" and "Why are cookies different from cake?" She concluded that reasoning is possible in the youngest child and that with age there is a persistent increase in answers which fall into "logical" and "statement of fact" categories.

Children develop breadth and depth in their concepts only after much firsthand and vicarious experience in the area involved. In the preschool years, up to five or six, Jersild (1947) suggested that the child "comes into his own as a thinking creature." His mental development is illustrated in many new powers, opening up whole new worlds to him. An everpresent problem of parents and teachers is the confusion of verbalization with true understanding. There is no better safeguard against meaningless verbalization and rote memorization than a teacher who is able both to appraise the difficulty of the concepts and to assess the children's comprehension of them (Almy, 1966). The most important implications of Piaget's work seem to lie in its contribution to the teacher's understanding and skill. Concepts must be presented so that the children can learn to grasp them. Concepts are necessarily incomplete until home, school, community, and the wider world can provide experiences against which to check the validity of a generalization. The complexity of modern culture makes the individual's task a tremendous one, and the enrichment of concepts undoubtedly continues through much of adult life (Russell, 1956).

Summary

Children in early childhood education programs need to have the opportunities for developing concepts through participating in intellectually stimulating activities to provide a foundation for later learnings. Concepts should be developed that will help young children understand themselves, others, their environment and the world.

Some aspects of cognitive development which have been identified in the literature include:

1. Identification and recall of objects and persons. Children need to be encouraged to observe characteristics of objects and persons. Children grow in their ability to observe and recall details and complex patterns of situations as they develop other mental functions. A high positive relationship is indicated between age and abilities in recall for preschool children.
2. Orientation in space and time (ordering). There is a "relatively uniform age sequence" in the development of major concepts of space and time. Many three-year-olds cannot develop a concept of middle size. By five years some children are capable of perceiving intermediacy.
3. Classification and differentiation based on percepted attributes, functions, roles, feelings, and processes. Three styles of classification have been identified in the literature. Descriptive classification includes grouping by color, form, or structure. Relational-contextual responses are made on the basis of use or thematic story. Grouping on the basis of function or class label is a categorical-inferential response. When asked to classify objects or shapes that are comparable in color, children under six

use color more often than older children. Boys used a significantly greater percentage of categorical responses than did the girls who used more relational-contextual responses.

4. Inferring causes, effects, and feelings based on sequence, prediction and outcome both in physical and the interpersonal realm. A study of the reactions of nursery school children to ambiguous picture material showed changes in perception and conceptualization influenced by personal factors.
5. Testing concepts and making choices (problem solving). Problem solving of young children takes place in concrete, immediate situations rather than in abstract, verbal ones.

Hierarchies in the development of thought processes have been hypothesized by certain investigators. These investigators contended that cognitive skills organize themselves into hierarchies. A review of literature suggests a lack of agreement about the specific processes involved in conceptual development and lack of application of such information to curriculum planning.

CHAPTER III

METHOD AND PROCEDURE

Description of Subjects

The subjects were twenty-two three-year-olds, nine males and thirteen females, and eighteen five-year-olds, nine males and nine females. The subjects participating in this research were enrolled in the Oklahoma State University Child Development Laboratories and Miss Carolyn's Preschool in Stillwater, Oklahoma during the spring semester, 1974.

Instrument

Development

Measurement of the cognitive behaviors of each child was obtained through the use of an instrument assembled by the investigator. The items in this instrument were selected from tests reported in the literature as measuring a cognitive process identified as part of a hierarchy of initial cognitive skills. The initial cognitive skills reported in the literature include: observing; recalling; recognizing differences and similarities; ordering according to size, shape and position; grouping; concept labeling; classifying; concept testing; inferring causes, effects, and feelings; concluding; questioning; anticipating; and making choices. From the initial cognitive skills

reported by previous investigators a selection was made in order to be able to obtain responses related to a variety of skills. In order that these cognitive skills could be tested in a fifteen to twenty minute session, the following eight skills were selected: observing; recognizing differences and similarities; ordering; classifying; concept testing; inferring causes, effects and feelings; making choices; and recalling. The investigator submitted the proposed items to two specialists in early childhood education to obtain their reaction. Both of the specialists felt that the test items seemed appropriate for use with children age three and five years. The complete instrument, with the original sources of the individual items, may be found in Appendix A. The instrument will be identified as the Schedule of Selected Thought Processes (SSTP).

Validity - Reliability

Several aspects of intellectual development in young children have been identified by many investigators. For this study, the investigator selected eight aspects from a list compiled from the literature. The test items were selected in toto or modified slightly from those having been used and reported by numerous investigators. Specific sources are reported for each item in Appendix A. It is concluded, therefore, that the instrument is assumed to have content validity.

A measure of reliability for the SSTP was obtained by calculating a Spearman rank-order correlation between the initial test scores and the retest scores and found for the total group a rho of .94 (significant beyond the .001 level). In order to determine whether the relationship held for both three-year-olds and five-year-olds, rho was

calculated for each of these groups. For the group of five-year-olds a rho of .57 (significant at .02 level) was obtained. A rho of .89 (significant beyond the .001 level) was obtained for the three-year-olds. It is concluded, therefore, that this test is reliable. The results may indicate, however, that five-year-olds are engaging in a wider variety of thought processes and therefore their responses are more varied than the responses of the three-year-olds.

Administration

The instrument, consisting of eight tasks measuring different foundation skills in thinking, was administered to nine male and thirteen female three-year-olds and to nine male and nine female five-year-olds to determine whether age and sex are significantly related to the strength and acquisition of these particular intellectual skills. The instrument was administered to each child individually in a small room with a table and two chairs used as a testing center. After the child was seated the examiner talked with each child in order to establish rapport. Then the examiner proceeded with the tests. The responses which the child made were recorded on a score sheet during the tests. The complete score sheet may be found in Appendix B.

Data

Collection

Trial use of the instrument was carried out with two children, one three-year-old and one five-year-old. On the basis of the trial administration no revisions were made. All of the children's responses were scorable. Responses from subjects were obtained during the spring

of 1974 using the instrument and score sheet described (Appendixes A and B). The instrument was administered to each child and a retest was administered seven to ten days after the initial test was completed.

Scoring

Scoring of all tests was done by the investigator and a specialist in early childhood education independently. Since the scoring consisted primarily of objective measures such as counting the number of observations or other specific responses such as those described in detail in the manual for scoring the OCT, scorer-bias did not seem to be a factor of concern. In order to have some means for making comparisons among the items it was decided to weight the scores so each item would have the same total possible score. Examination of the completed tests suggested that eighteen points for each item might be a reasonable weighted score. The weighted scores were calculated as follows:

Item #1 (observing). For this item no child gave more than eighteen observations. The investigator assigned one point for each observation recorded.

Item #2 (noticing differences and similarities). This test included nine possibilities for identifying similarities and nine possibilities for identifying differences. Allowing one point for each correct response gave possible total of eighteen.

Item #3 (ordering). Powell (1974), Thrum (1935), and Hicks and Stewart (1930) reported that younger children had difficulty in arranging three items in order. On the basis of previous findings the scores were weighted so the item on order of development was worth slightly more than the combination of identifying youngest

and oldest. For identifying the youngest and/or oldest a numerical value of "2" was given for each. A value of "5" was given for identifying the order of development including the concept of intermediacy.

Item #4 (classifying). The responses to Item #4 were classified according to Sigel's scoring manual for the Object Categorization Test. Each response was identified as to verbal level of response (grouping, non-grouping, non-scorable) and style of categorization (descriptive, relational-contextual, categorical). Numerical values were assigned to these categories in order to facilitate scoring of the SSTP. Non-scorable responses were given a value of "0", non-grouping were given a value of "1" and grouping were given a value of "2". An additional score value was assigned to each of the grouping and non-grouping responses. These values were "1" for descriptive responses, "2" for relational-contextual responses and "3" for categorical responses. Previous users have reported in the literature that descriptive modes of classification are most frequently used by less mature children.

Examination of the completed tests showed raw scores for Item #4 ranged from zero to thirty-six. The raw score was divided by two to make the weighted score of eighteen.

Item #5 (testing concepts). In examining the raw scores for Item #5, 88.8% of the five-year-olds and 88.6% of the three-year-olds got perfect scores on the item. In view of this non-discriminating response, the raw score was retained rather than the weighted score to contribute to the total score for the instrument. The investigator felt that weighting the score from two to eighteen

would make the total score spuriously high. In order to compare the weighted scores of the items in relation to Hypothesis III, the raw score was multiplied by nine to make a total possible score of eighteen.

Item #6 (inferring cause-effect and feeling). No child gave more than six responses making a possible raw score of six. Each response was given a weight of three, giving a total possible weighted score of eighteen.

Item #7 (making choices). In conference with one specialist in child development, the following values were assigned to the possible responses.

Which of these would you wear on a cold day?

Bathing suit	-2
Coat	2
Hat	1
Mittens	1
Pajamas	0
Boots	1
Shorts	-1

Which of these would keep you the warmest on a very cold day?

Coat	4
Boots	1
Hat	1
Mittens	1

Total possible raw score for this item is nine, making the weighted score eighteen by weighting each response times two.

Item #8 (recalling). For this item no child gave more than eighteen observations by recall. One point was given for each observation the individual recalled.

Analysis

Comparisons of the responses of each child on the initial test and on the retest were made to establish a measure of reliability. Responses to the initial test only were used for testing the hypotheses in this study. The responses to each test item were compared in relation to the variables of age and sex. Nonparametric statistical methods were used for these comparisons, including chi square, median test, Mann-Whitney-U and Friedman two-way analysis of variance test.

CHAPTER IV

RESULTS

Hypothesis I: There is no significant difference among total scores on the Schedule of Selected Thought Processes (SSTP) according to age or sex. A significant difference was found between the responses of the three-year-olds and the responses of the five-year-olds when examined by the median test. A chi square value of 20.08 was obtained which was significant beyond the .001 level. Examination of the data leads to the conclusion that there were more fives who scored above the median score and more threes who scored below the median score. By inspection of the data it was observed that exactly the same number of males scored above and below the median and exactly the same number of females scored above and below the median. It can be concluded, therefore, that scoring on this instrument is not related to sex for the total group. It appeared possible that there might be differences according to sex in one age group or the other. The median test was used to examine the responses of three-year-old males verses three-year-old females and for five-year-old males verses five-year-old females. A chi square value of 4.37 for the three-year-old group and 5.07 for the five-year-old group was obtained, neither of which allowed for the rejection of the null hypothesis.

Hypothesis II (A): On Item #1 (observing) there is no significant differences among scores according to age or sex. The median

test was used to examine this hypothesis. In comparing the responses of five-year-olds with the responses of three-year-olds a chi square value of 8.00 was obtained, allowing for rejection of the null hypothesis at the .02 level. It is concluded, therefore, that five-year-olds scored significantly higher on observing than did three-year-olds. In comparing responses according to sex, a chi square value of .15 was obtained. It is concluded, therefore, that there are no differences on the observation sub-test scores according to sex.

Hypothesis II (B-1): On Item #2 (recognizing similarities and differences) there is no difference according to age or sex on complete scores for item. The median test was used to examine this hypothesis. In comparing the responses of five-year-olds with the responses of three-year-olds a chi square value of 20.28 was obtained, allowing for rejection of the null hypothesis at the .001 level. It can be concluded, therefore, that five-year-olds are significantly better able to recognize similarities and differences than three-year-olds. In comparing responses of boys with responses of girls it was observed that exactly one-half (9) of the boys scored above the median and one-half below the median. Nine of the girls scored below the median and thirteen scored at or above the median. From inspection of these data it is apparent that sex is not related to recognizing similarities and differences.

Hypothesis II (B-2): On Item #2 (recognizing similarities and differences) there is no difference according to age or sex on comparison of scores for similarities and scores for differences. All of the five-year-olds gave correct responses in identifying both similarities and differences. In examining the responses of three-year-olds, the

Friedman two-way analysis of variance was used to compare the responses identifying similarities with the responses identifying differences. A value for Xr^2 of 6.84 was obtained. This value is considered significant at the .01 level allowing for the rejection of the null hypothesis. From examination of the data, it can be concluded that this group of three-year-olds was able to recognize similarity or sameness better than they could recognize differences. Examination of the responses of the three-year-olds according to sex revealed that six children gave equally scored responses to both similarities and differences. Of the remaining children, only one girl showed a higher score for recognizing differences than for recognizing similarities. Eight boys and seven girls, of the remaining children, scored higher on recognizing similarities. It can be concluded, therefore, that there are no differences in recognizing similarities and differences according to sex.

Hypothesis II (B-3): On Item #2 (recognizing similarities and differences) there is no difference according to age or sex on recognition of differences in object, color, or shape. All of the five-year-olds gave appropriate responses, so statistical analysis was applied only to the responses of the three-year-olds. In view of the fact that no sex differences had been found in total scores or scores for this item, the responses of the three-year-olds were analyzed as a total group for this comparison. In examining the responses of the three-year-olds, the Friedman two-way analysis of variance was used to compare the responses identifying differences in object, color and shape. A value for Xr^2 of 27.36 was obtained. This value is considered significant at the .01 level allowing for the rejection of the

null hypothesis. It can be concluded, therefore, that three-year-olds are less able to identify different geometric shapes than they are different colors or different known objects.

Hypothesis II (C-1): On Item #3 (ordering by age) there is no significant difference according to age or sex on complete scores for item. The median test was used to examine this hypothesis. In comparing the responses of the five-year-olds with the responses of the three-year-olds a chi square value of 17.07 was obtained, allowing for the rejection of the null hypothesis beyond the .001 level. From examination of the data, it can be concluded that five-year-olds are significantly better able to order by age than are three-year-olds. The responses by sex were approximately equally distributed, leading to the conclusion that ability to order was not related to sex for this group of children.

Hypothesis II (C-2): On Item #3 (ordering by age) there is no significant difference according to age or sex on ability to identify "youngest", "oldest", and order of development for chick and person. The data were analyzed by the use of chi square in comparing the responses of the five-year-olds with the responses of the three-year-olds in identifying "youngest", "oldest" and order of development of the chick. The following X^2 values were obtained: "youngest," 4.05 ($p<.05$); "oldest," 10.23 ($p<.01$); and order, 16.84 ($p<.001$). The chi square analysis was also used in comparing the responses of the five-year-olds with the responses of the three-year-olds in identifying "youngest", "oldest", and order of development of the person. The following X^2 values were obtained: "youngest," 6.07 ($p<.02$); "oldest," 14.83 ($p<.001$); and order, 22.35 ($p<.001$). Identifying youngest,

oldest, and order of age appear to be increasingly difficult judging by the magnitude of differences between the responses of the threes and the responses of the fives. Since the responses on the total score for this item were approximately equally distributed no further analysis according to sex were made.

Hypothesis II (D-1): On Item #4 (classifying) there is no significant difference according to age or sex on complete scores for item. A significant difference was found between the responses of the three-year-olds and the responses of the five-year-olds on Item #4 when analyzed by the median test. A chi square value of 20.13 was obtained which was significant beyond the .001 level. It can be concluded, therefore, that five-year-olds are significantly better able to classify than are three-year-olds. In comparing responses of boys with responses of girls it was observed that exactly one-half (9) of the boys scored above the median and one-half below the median. Ten of the girls scored below the median and thirteen scored at or above the median. From inspection of these data, it is apparent that sex is not related to classifying.

Hypothesis II (D-2): On Item #4 (classifying) there is no significant difference according to age or sex on level of verbal response. Among the five-year-olds, 92% of the responses of the males and 97% of the responses of the females were grouping responses. No further statistical analysis was carried out. The Mann Whitney U test, corrected for ties, was used to examine the significance of the difference of the responses of the three-year-old males as compared with the three-year-old females. A z score of .62 was obtained which did not allow for the rejection of the null hypothesis. It is concluded,

therefore, that there is no difference in the number of grouping responses for males or females at either age five or age three.

Hypothesis II (D-3): On Item #4 (classifying) there is no significant difference according to age or sex on style of categorization. By inspection of the data, it was observed that three-year-old males and females and five-year-old males and females gave more descriptive responses than relational and categorical responses and that all groups gave more relational responses than categorical responses. The percentages of responses are as follows: Descriptive responses--three-year-old males, 73%; three-year-old females, 80%; five-year-old males, 58%; and five-year-old females, 63%. Relational responses--three-year-old males, 19%; three-year-old females, 16%; five-year-old males, 28%; and five-year-old females, 28%. Categorical responses--three-year-old males, 09%; three-year-old females, 04%; five-year-old males, 14%; and five-year-old females, 11%. Chi square analysis was used in comparing the responses of the three-year-olds and the five-year-olds on incidence of categorical response. A chi square value of 7.83 was obtained, which was significant at the .01 level. It can be concluded, therefore, that five-year-olds used a significantly greater number of categorical responses than the three-year-olds.

Hypothesis II (E): On Item #5 (differentiating between critical and optional attributes of objects) there is no significant difference among scores according to age or sex. By inspection of the responses of the three-year-olds and five-year-olds, it was obvious that the three-year-olds and the five-year-olds seemed to be able to equally differentiate between critical and optional attributes of objects on the SSTP. Examination of the data leads to the conclusion, therefore,

that this was an inappropriate test because five-year-olds should be able to differentiate at a more advanced level than three-year-olds.

Hypothesis II (F): On Item #6 (inferring cause-effect and feelings) there is no difference among scores according to age or sex. It can be noted from the data reported in Table I that five-year-olds gave more responses inferring both cause-effect and feelings and fewer "no responses" than three-year-olds. As with the other responses, sex was apparently not related to responses since approximately equal responses were given by both males and females at both age three and age five.

TABLE I

PERCENTAGES OF CHILDREN INFERRING CAUSE-EFFECT AND FEELING

Group	Cause-Effect Percentages	Feeling Percentage	None Percentage
Three-year-olds	68	0	32
Five-year-olds*	94	22	6

*Some five-year-olds made inferences as to both cause-effect and feelings in response to the same stimulus.

Hypothesis II (G): On Item #7 (making appropriate choices) there is no significant difference among scores according to age or sex. In order to examine this hypothesis, the median test was used. In comparing the responses of five-year-olds with the responses of three-year-olds, a chi square value of 10.96 was obtained, allowing for the rejection of the null hypothesis beyond the .001 level. It can be concluded,

therefore, that there is a significant difference between the five-year-olds and the three-year-olds in their ability to make choices. The five-year-olds made a significantly greater number of choices than the three-year-olds. Examination and comparison of the responses according to sex revealed a chi square value of .55 ($p < .50$). No significant difference was found between males and females in making appropriate choices.

Hypothesis II (H): On Item #8 (recalling) there is no significant difference among scores according to age or sex. The median test was used to examine this hypothesis. In comparing the responses of five-year-olds with the responses of three-year-olds a chi square value of 22.96 was obtained allowing for rejection of the null hypothesis beyond the .001 level. Examination of the data leads to the conclusion that there is a significant difference in ability to recall according to age. The five-year-olds recall a significantly greater number of items than the three-year-olds. It was observed that ten boys scored at the median or above and eight scored below, and twelve girls scored at the median or above and ten scored below, leading to the conclusion that responses to this item were not related to sex.

Hypothesis III: There is no hierarchy of development of thought processes as measured by average scores on subtests or by differences between average scores for three-year-olds and five-year-olds. The data related to this hypothesis was examined through the use of descriptive statistics and not inferential. Table II identifies the relationship of the scores for each age group on each of the subtests. On the basis of the data available a hierarchy of development for these eight processes of thinking is not clearly apparent. Three cognitive processes which appear to be related are Item #2 (recognizing

TABLE II

WEIGHTED SCORES FOR ITEMS #1-8 OF SSTP

	Average Five-year-old Scores	Average Three-year-old Scores	Difference in Average Scores
Item #1 (Observing)	11.11	8.68	2.43
Item #2 (Noticing differences and similarities)	18.00	13.41	4.59
Item #3 (Ordering)	15.83	6.50	9.33
Item #4 (Classification)	13.44	6.45	6.99
Item #5 (Concept testing)	15.93	15.93	0.00
Item #6 (Inferring cause-effects and feeling)	5.17	2.18	2.99
Item #7 (Making choices)	15.78	10.73	5.05
Item #8 (Recalling)	8.00	3.09	4.91

similarities and differences), Item #3 (ordering) and Item #4 (classifying). It may be observed that the greatest difference occured between the scores of the three-year-olds and the five-year-olds in their ability to "order". The least difference occured in responses to recognizing similarities and differences. Item #1 and Item #8 also appear to be related. Observation skill is more highly developed than recall both in terms of absolute scores and in terms of the difference between the scores of the two age groups. In reference to Item #7

(making appropriate choices) the choices offered were within the experience of the child, therefore, all the children scored rather high, but a noticeable difference was observed between the three's and five's responses. Item #6 (inferring cause-effect and feelings) received the lowest average scores and the lowest difference between means. This is probably due to lack of ability of both groups. Item #5 (differentiating between critical and optional attributes of objects) was an inadequate measure for this thought process in view of the fact that the scores for the three-year-olds came out exactly like the scores for the five-year-olds.

CHAPTER V

SUMMARY AND DISCUSSION

Summary

The present research was a study of selected cognitive processes of three-year-old and five-year-old children. The purpose was to investigate and learn more about these thought processes and to determine whether these particular processes could be identified in a testing situation and whether variables of age and sex would be significantly related to the strength and acquisition of these particular cognitive skills.

The subjects of this study were forty preschool children selected from the Oklahoma State University Child Development Laboratories and Miss Carolyn's Preschool in Stillwater, Oklahoma. There were nine three-year-old males, thirteen three-year-old females, nine five-year-old males and nine five-year-old females in the sample. Data were obtained during the spring semester, 1974.

The SSTP, designed for use with preschool children, was developed and administered to all subjects. The instrument consisted of eight subtests which measured different cognitive processes. The SSTP was readministered to the children after a seven- to ten-day interval.

The results of the analysis of the data of this study were as follows:

1. The total scores of the five-year-olds were significantly

higher than the total scores of the three-year-olds on the SSTP ($p<.001$), but no significant difference was found according to sex in one age group or the other.

2. Five-year-olds scored significantly higher ($p<.02$) on observation than did the three-year-olds. There was no significant difference on the observation subtest scores according to sex.
3. Five-year-olds are significantly ($p<.001$) more able to recognize similarities and differences than three-year-olds. Sex is not related to recognizing similarities and differences. Three-year-olds are able to recognize similarities better than they can differences ($p<.01$). Threes are less able to identify geometric shapes than they are different colors or different known objects ($p<.01$).
4. Five-year-olds are significantly ($p<.001$) better able to order by age than are three-year-olds. The responses by sex were approximately equally distributed, leading to the conclusion that ability to order was not related to sex for this group of children.
5. Five-year-olds are significantly ($p<.001$) better able to classify than three-year-olds. There is no difference in the number of grouping responses for males or females at either age five or age three.
6. Three-year-olds and five-year-olds seemed to be equally able to differentiate between critical and optional attributes of objects.
7. It can be noted from the data reported that five-year-olds gave more responses inferring both cause-effect and feelings

and fewer "no responses" than three-year-olds. Sex was apparently not related to responses since approximately equal responses were given by both males and females at both age three and age five.

8. The five-year-olds made a significantly ($p<.001$) greater number of choices than the three-year-olds. No significant difference was found between sexes.
9. The five-year-olds recalled a significantly ($p<.001$) greater number of items than the three-year-olds.
10. On the basis of responses to the SSTP a hierarchy of development for the eight processes of thinking examined is not apparent. The greatest difference between the scores of the three-year-olds and the five-year-olds was in their ability to "order".

Discussion

In relating the findings of the present study to those reported in the literature it may be noted that Olmsted, Parks, and Rickel (1970) and Kofsky (1966) reported that children move from sorting on observable attributes to grouping on the basis of unseen or inferred characteristics. The findings of the present study of more descriptive than either relational or contextual styles of categorization being used support the findings reported by Olmsted, et.al., and Kofsky.

Allen (1971) reported that boys used a significantly greater percentage of categorical responses than did girls. In the present study this finding was not substantiated.

In the literature, Amen (1941) reported inference as to psychological states being common at four. This finding was not substantiated in the current study.

In relating the findings of the current study pertaining to ordering to those reported in the literature, it may be noted that Hicks and Stewart (1930) reported that twos and many threes could not develop the concept of middle size and Thrum (1955) noted many inaccuracies in concepts of magnitude. Thrum reported that the "biggest" is named most readily and by age five some children are capable of perceiving intermediacy. The results of the present study support the findings of Hicks, Stewart, and Thrum.

In the literature it may be noted that Eysenck and Halstead (1945) reported that girls have a slight advantage over boys of the same age in recalling. This finding was not substantiated in the current study.

Implications

1. Both three-year-old and five-year-old children are capable of developing skill in observing. This finding supports the desirability of including activities to encourage careful observation in early childhood education programs.
2. As children mature, teachers should plan activities which encourage the noticing of similarities and differences. The results of this study indicated that the children recognize similarities better than they did differences, so a curriculum may emphasize similarities before emphasizing differences.
3. Both tasks of ordering and classifying appear to be more difficult than the task of recognizing similarities and

differences. An implication of this finding is the need for providing experiences in recognizing similarities and differences prior to expecting children to be able to order or to classify.

4. For items "ordering" and "classifying" the results seem to suggest that children become able to order earlier than they develop skill in classification as judged by the greater difference in the mean scores.

5. The extremely low score on the item for inferring cause-effect and feelings may reflect a real lack in ability to make these kinds of inferences. However, in view of the fact that there is only a three point difference in the mean score for the three-year-olds and the five-year-olds this suggests that this test is not an adequate measure of the children's abilities. The assumption should not be made that three-year-olds are equally competent to make such inferences as are five-year-olds.

6. The results on the item for making choices seem to suggest that even three-year-olds are capable of making appropriate choices in the areas in which they have had experience.

7. Children recalled less than they observed. The three-year-olds recalled a small proportion when compared with the five-year-olds, which substantiates the need for teachers not to expect too much of the three-year-olds.

Recommendations for Further Research

The investigator feels that further study of the thought processes of children is indicated as a result of this study. The following suggestions are made on the basis of the findings of this study:

1. The investigator suggests gathering further information through the use of the test items before drawing any general conclusions.
2. A better test item needs to be developed for differentiating between critical and optional attributes of objects.
3. A less abstract means for testing the child's ability to infer cause-effect and feelings should be found.
4. Another test for measuring children's ability to make choices should be found because of the high level responses by both age groups. Other kinds of choices children are able to make would be desirable observations.

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APPENDIX A

INSTRUMENT

THE SCHEDULE OF SELECTED THOUGHT PROCESSES (SSTP)

TASK ONE (From Nimnicht, McAfee, and Meier, 1969)

Observing - the ability to notice one or more attributes of a picture.

Items employed:

Picture taken from Bowmar series. Picture Story Set III - B #1 (Picture of common activity - a grandmother putting two children to bed.)

Procedure:

The child is shown a scene of some people performing a familiar action. After the child has had a chance to look at the picture, discuss it with him. Discussion may be elicited by asking - "What do you see in the picture?", "Tell me what is happening in the picture," or "What are the people doing in the picture?" The responses which the child makes will be recorded on a score sheet combining a category system and open-end response.

TASK TWO (From Robison and Schwartz, 1972)

Noticing Differences and Noticing Similarities - the ability to identify one or more different or similar attributes of two or more objects.

Items employed:

Three identical sets of 6 common objects, as follows:

2 orange plastic spoons

2 orange plastic forks

2 blue counting cubes

2 blue wooden beads

2 yellow wooden triangles

2 yellow wooden circles

Procedure:

"We are going to play a game. I have some very special things for you to play with. I want you to tell me the name of each of these things we will be playing with (present two sets of objects)." The objects are laid out in a predetermined order, so that items are not juxtaposed according to class or color. From the examiner's set, pick up one of each pair of objects in turn and say to the child:

"Please pick up an object which is different from this one."

Repeat the above procedure,

"Please pick up something with a different color."

Repeat the above procedure,

"Please pick up something with a different shape."

"Please pick up an object which is the same as this."

"Please pick up an object which is the same color as this."

"Please pick up an object which is the same shape as this."

The responses which the child makes will be recorded categorically on the score sheet.

TASK THREE (From Powell, 1974)

Ordering - the ability to order objects or events according to given attributes or criteria.

Items employed:

Three photographs depicting growth of a chicken - chick hatching out of the egg, an older chick, and a hen. Three photographs of males - a young boy, an adult, and an old man. Three photographs of ladies - a young girl, an adult, and an old woman. Have sets of pictures in separate envelopes.

Procedure:

A. "I have some pictures in this envelope (chickens). Would you like to take them out of the envelope so we may play a game?" After the photographs are displayed proceed with the following questions:

"Show me the youngest chicken."

"Show me the oldest chicken."

"Put all three pictures in a row to show how the chicken grew up."

The responses which the child makes will be recorded categorically on the score sheet.

B. "I have some pictures of men and some pictures of ladies. Which would you rather play with?" After the photographs of either the men or ladies are displayed, proceed with the appropriate set of questions:

"Here are some pictures of a man (or lady). Show me the boy (girl), or the youngest one."

"Which is the oldest?"

"Put all three pictures in a row to show how the boy (girl) grew up and then became an old man (old woman)."

The responses which the child makes will be recorded categorically on the score sheet.

TASK FOUR (From Sigel and Olmsted, 1969)

Classification of objects - the ability to include items under a label or with others called by the same name.

Items employed:

Small green notebook

Yellow pencil

Green cup

Blue spoon

Blue ball

Blocks - blue, yellow, green, red

Surprise box

Procedure:

"We are going to play a game. I have some things in this Surprise Box. I want you to tell me the name of each as I take it out of the box." The objects will be laid out in a predetermined order, so that items are not juxtaposed relative to class or color. When all the items are placed in an array, the experimenter will select the stimulus object and say to the child, "Look over all the objects that are here (pointing to total array of objects) and put the ones that are the same or alike in any way with this one" (pointing to the stimulus object). If no response is given, the instructions will be repeated with the phrase "belong together with this one" substituted for "alike or the same in any way." After the child selects the objects to group with the stimulus object, the responses will be recorded on the score sheet.

The child will then be asked to explain the grouping. The child will be asked "Why" followed by the phrase to which he responded when grouping. The inquiry phrase will be "Why do these things belong together?" The child's answer will be recorded on the score sheet verbatim.

TASK FIVE (From Sigel, Gordon, and Taba, 1971)

Concept testing - the ability to differentiate between critical and optional attributes.

Items employed:

two pictures - one of an orange and one of a coffee cup

Procedure:

"I have two pictures to show you." Show one picture at a time and have the child identify the picture. Then procede with the appropriate question:

"If this orange were peeled, would it still be an orange?"

"If this cup didn't have a handle, would it still be a cup?"

The child's responses will be recorded on the score sheet.

TASK SIX (From Croft and Hess, 1972)

Inferring causes, effects, and feelings - the ability to make inferences about the variety of effects of one thing on other things and the ability to make inferences about how people feel in particular situations.

Items employed:

Picture taken from the David Cook Publishing Co. series entitled Social Development - Teaching Pictures, Resource Sheet No. 4, "Helping Brothers and Sisters." (Picture of a young boy helping a young girl whose bicycle has overturned and she has fallen off.)

Procedure:

Display the picture for the child to see. Let the child volunteer his observations. Then ask:

"What is happening in this picture?"

"What do you think happened just before this picture?"

"What do you think will happen next?"

The responses which the child makes will be recorded on the score sheet.

TASK SEVEN (From Dunn, Horton, and Smith, 1968)

Making Choices - ability to make choices based on given criteria.

Items employed:

Picture cards of:

coat

boots

hat

mittens

bathing suit

pajamas

shorts

Procedure:

Present picture cards to child one at a time so he may identify them. Then proceed with the following questions:

"Which of these would you wear on a very cold day?"

"Which of these would keep you the warmest on a very cold day?"

The responses will be recorded on the score sheet.

TASK EIGHT (From Nimnicht, McAfee, and Meier, 1969)

Recalling - ability to recall specific data from the picture observed previously.

Procedure:

"Remember the picture we looked at in the very beginning. What do you remember about that picture?" If necessary, response may be elicited by giving a small hint. Ex.: "Wasn't there something in the picture that was black and furry and could be a pet?" The child's responses will be recorded on the score sheet.

APPENDIX B

SCORE SHEET

SCORE SHEET

Number_____ Sex_____
Age_____ Test_____

	Test 1 (Observation)	Test 8 (Recall)
Adult (grandmother)		
Brother		
Sister		
Other child		
Dog		
Toy box		
Doll		
Table		
Chairs		
Crayons and paper		
Books		
Jar		
Cowboy hat		
Holster		

Test 2 (Same-Different)	First		Second		Third	
	Cor.	Inc.	Cor.	Inc.	Cor.	Inc.
Different object						
Different color						
Different shape						
Same object						
Same color						
Same shape						

Test 3 (Ordering)	Correct	Incorrect	Comments
Youngest chicken			
Oldest chicken			
Order of development			
Boy or girl youngest			
Oldest			
Order of development			

Test 4 (Classification)

No Pe Cu Sp Ba Bl

Sort: Notebook

A._____
B._____
C._____

No Pe Cu Sp Ba Bl

Sort: Pencil

A._____
B._____
C._____

No Pe Cu Sp Ba Bl

Sort: Cup

A. _____
B. _____
C. _____

No Pe Cu Sp Ba Bl

Sort: Spoon

A. _____
B. _____
C. _____

No Pe Cu Sp Ba Bl

Sort: Ball

A. _____
B. _____
C. _____

No Pe Cu Sp Ba Bl

Sort: Block

A. _____
B. _____
C. _____

Test 5 (Testing Concepts) Correct Incorrect

Orange

Cup

Test 6 (Inferring Causes, Effects and Feelings)

What is happening in this picture? _____

What do you think happened just before this picture? _____

What do you think will happen next? _____

Test 7 (Making Choices)

Which of these would you wear on a cold day?

_____Bathing suit
_____Coat
_____Hat
_____Pajamas
_____Mittens
_____Boots
_____Shorts

Which of these would keep you the warmest on a very cold day?

_____Coat
_____Boots
_____Hat
_____Mittens

VITA

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