CONCEPTUAL DEVELOPMENT OF THREE- AND FOUR-YEAR-OLDS WITH REGARD TO SHAPES AND COLORS AND THE LANGUAGE USED TO DESCRIBE THESE CONCEPTS

by

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Chapter I

THE NATURE OF THE PROBLEM

As children explore the world in which they live, they learn to recognize, name, and describe objects that they see. Objects are recognized on the basis of certain physical properties (color, size, shape, or certain patterns of behavior). A child begins at an early age to classify objects into specific categories, based on certain unique characteristics or properties. As new objects are discovered, they are classified in relation to objects already discovered.[1]

This study examines the ability of children to classify objects according to shape and color and their ability to express their knowledge of these concepts. The children in this study are three- and four-year-olds. They are in Piaget's preoperational stage of intellectual development which usually includes the ages from two to seven. In this stage the child uses symbols crudely; he begins to use words to represent objects, and language develops very rapidly, especially around age four. He is perceptually oriented and can see things from only one point of view; reversible thought is not possible. Gradually the child begins to judge by what he knows as well as by what he sees.[2]

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[1]Richard W. Copeland, How Children Learn Mathematics--Teaching Implications of Piaget's Research (New York: Macmillan Publishing Company, 1974), p. 52.

[2]American Institute for Research in Behavioral Sciences, "Perry Preschool Project--Ypsilanti, Michigan," It Works, (1971), ED 027 975, p. 3.

Preschool children, ages three to five, are usually developmentally ready to learn shapes and to classify by colors.[3] The concepts of shape and color are considered to be less complex than other concepts because they have only one or two attributes that may be observed; therefore, these concepts may be learned early in life or the beginnings of these concepts may be formed early in life.[4] However, all children do not possess the same degree of conceptual knowledge. Children of the same age and similar ages may vary widely in the accuracy and totality of their concepts.[5] This study examines differences between three- and four-year-olds with respect to the conceptual development of shapes and colors.

Classification concepts are basic to intellectual operations and are foundations for logical thought.[6] The conceptual development of shape and color falls in the category of classification. Piaget states that its development begins early in life and continues gradually until a degree of equilibrium is achieved. The results of one research study show that the ability to classify increases with age and that sex differences are insignificant.[7]

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[3]Dorothy Anker and others, "Thinking Is Child's Play," Young Children, XXIX (May, 1974), p. 212.

[4]Herbert J. Klausmeier and others, "Concept Learning: A Bibliography--July-December, 1969," (Wisconsin University, November, 1970), ED 046 033, p. 9.

[5]Klausmeier, p. 10.

[6]Tami Thi Wei, "Piaget's Concept of Classification: A Comparative Study of Socially Disadvantaged and Middle Class Children," (Wisconsin University, 1969), ED 046 499, p. 1.

[7]Wei, p. 3.

The extensiveness and complexity of language used by the children in responding to questions concerning shape and color is noted in this study. Children, by age four or five, have mastered their own language so well that they can make up and understand amazingly complex sentences, including sentences they have never heard or said before.[8] In this study language used by the children is recorded in order to determine how much each child knows about the concepts of shape and color and to determine the complexity of his language structures. Preschool children may be able to verbalize about and identify some of the shapes and colors, but they may not have grasped the full meaning of the concepts.[9]

The present study is designed to provide further understandings concerning the conceptual development of three- and four-year-olds, as related to the concepts of shape and color. The investigation may also provide basic information for further studies in this age range in the area of conceptual development of these two concepts and accompanying language.

Statement of the Problem

This study attempts to aid in achieving a better understanding of the nature and extent of conceptual development among three- and four-year-old children as indicated through examining the categories of shape and color and the language they use to express their ideas about the shapes and colors.

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[8]Lester G. Butler, "Language Acquisition of Young Children: Major Theories and Sequences" (November, 1973), ED 904 403, p. 8.

[9]Ibid.

The specific experimental hypotheses which the present study is designed to answer are the following: (1) Evidences of conceptual knowledge about colors and shapes and the necessary language to describe these adequately will not be found in the interview responses with subjects in the study. (2) There will be no significant differences in conceptual knowledge between three-year-olds and four-year-olds.

Delimitation of the Study

The proposed investigation was designed to examine two tasks associated with conceptual development--recognition of shape and color. The language each child uses to express his ideas about the concepts will also be considered as a related matter.

The sample of children included in the present study was restricted to white middle to upper middle class children in the northwestern region of North Carolina. No attempt was made to include children of different socio-economic levels or children of racial minorities. Neither was any effort made to determine the IQ levels of the children in the study. Since all the subjects were obtained from one school in a single geographic location, results of the study cannot be generalized for a large population. Another factor limiting the generalization of the study is the small size of the sample.

Definition of Terms

Since the following terms used in the study are of special significance, definitions are given below:

Color. This term describes the primary and secondary colors: red, blue, yellow, purple, green, and orange.

Language. This term describes the verbalizations concerning colors and shapes. It is the means of communicating ideas or feelings through the use of articulate vocal sounds.

Shape. This term describes the outward form or outline of an object. The names of shapes included in this study are the regular geometric figures, i.e., triangles, squares, circles, and rectangles.

Order of Presentation

The present chapter deals with an overview of the problem and intent of the study. Chapter II reviews the relevant professional literature available and indicates its relationship to the present investigation. A detailed review of the design of the study and the procedures utilized to test the hypotheses are included in Chapter III. The findings of the study are covered in Chapter IV. In the fifth chapter an attempt is made to interpret and discuss the findings of the total study.

Chapter II

REVIEW OF THE LITERATURE

The work of Jean Piaget in the development of human intelligence called attention to the various types of tasks children are usually able to perform at each level.[10] This study includes a sample of children who are in the preoperational stage of intellectual development. In this stage children begin learning to use symbols such as language and mental images, rather than depending solely on direct action.[11] The children move toward the level in which they will use their mental capacity to order and to relate experiences into an organized whole.[12]

By the end of the preconceptual substage (age 2-4½ years) of the preoperational stage, the child begins conceptual thinking, yet his thinking continues to be egocentric. He can classify objects correctly or possibly put the objects in order of size. If a child in this stage is asked to sort colored shapes into ones that go together, he will arrange them in lines by color or shape, but not by both at the same

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[10]Grace Smith, "On Listening to the Language of Children," Young Children, XXIX (March, 1974), p. 47; see also Mary Ann Spencer Pulaski, Understanding Piaget--An Introduction to Children's Cognitive Development (New York: Harper and Row, Publishers, 1971), p. 25.

[11]Smith, p. 135.

[12]Ibid.

time.[13] If an action is not internalized, the child cannot form the mental actions necessary to reach a result. He does not have the mental structure to enable him to make comparisons. At this stage he makes judgments primarily on the basis of sensory perception,[14] rather than abstract thought processes.

From two to four the child is egocentric, using himself as the standard of judgment and cannot take another person's viewpoint.[15] He categorizes on the basis of single attributes of objects and cannot form one classification from a variety of characteristics simultaneously. In the intuitive phase (generally age 4-7) three basic mental operations appear: the ability to think in terms of classes, to see relationships, and to deal with number concepts.[16] He can classify objects (such as triangles and squares) by shape and color.[17]

Perception is the ability to recognize stimuli from direct contact with them. This ability encompasses receiving sensory impressions from the external world and from one's own body as well as the capacity to explain and recognize these impressions by relating them to prior experiences. This process of recognizing and classifying stimuli occurs

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[13]Ruth M. Beard, An Outline of Piaget's Developmental Psychology for Students and Teachers (New York: Basic Books, Publishers, 1969), p. 10.

[14]Beard, p. 11.

[15]Irving E. Sigel, "The Attainment of Concepts," in Review of Child Development Research, by Martin L. Hoffman and Lois W. Hoffman, eds. (New York: Russell Sage Foundation, 1964), p. 217.

[16]Hoffman and Hoffman, p. 218.

[17]Hoffman and Hoffman, p. 219.

in the brain. Of the two major senses, hearing and sight, sight seems to be the more important in the perception of one's surroundings.[18] Discrimination is the ability of a child to sort out and to distinguish differences among stimuli. The child must take in and synthesize stimuli from the different sensory mechanisms before he can adequately discriminate.[19] Visual discrimination and perception is focused upon in this study through the testing of color and shape matching, recognition, and sorting.

As a child grows, he learns to identify objects through visual perception.[20] When he enters school, accurate perceptual capacities enable a child to learn to read, to write, and to accomplish other tasks involving recognizing and reproducing visual symbols.[21]

Maximum development of visual perception usually occurs between three and one-half and seven and one-half years of age.[22] Many children experience a developmental lag which can cause difficulty in recognizing objects and their spatial relationships. They may be uncoordinated in the performance of daily tasks and in sports and games. Most important, the confused visual perception of symbols may cause difficulty with academic learning, regardless of their degree of intelligence.[23] Form

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[18]Marianne Frostig and David Horne, The Frostig Program for the Development of Visual Perception (Chicago: Follett Publishing Company, 1964), p. 7.

[19]Lawrence N. Gould, "Visual Perception Training," The Elementary School Journal (April, 1967), p. 382.

[20]Frostig and Horne, p. 7.

[21]Frostig and Horne, p. 8.

[22]Ibid.

[23]Ibid.

or shape constancy may involve such tasks as detecting squares and circles from other shapes.[24] Children with inadequately developed shape constancy may have difficulty in scholastic learning. They may learn to identify a number, letter, or word when seen in a certain form. However, they may not recognize the same symbol if it is presented differently.[25]

In addition to the previously stated problems, a child with visual perception disabilities may also have emotional handicaps. He may be conscious of his handicap and become ashamed and angered, which often emerges as behavior problems. Research shows that children with low scores on visual perception tests are often the lowest in scholastic achievement and the most poorly adjusted in the classroom.[26] This study attempts to test two aspects of visual perception, shape and color identification.

The development of visual constance depends partly on learning and experience; therefore, it is implied that this ability can be acquired through training. It also suggests that training should be through gaining familiarity with simple shapes and size ranges, succeeded by tries to name them in increasingly difficult contexts, sizes, and colors. Familiarity with a perceived object and the manner in which it

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[24]Marianne Frostig, Welty Lefever, and John Whittlesey, "Disturbances in Visual Perception," The Journal of Educational Research, 57 (November, 1963), p. 160.

[25]Frostig and Horne, p. 35.

[26]Frostig and Horne, p. 8.

is seen is not sufficient for gaining shape constancy. It must also be viewed accurately in relation to surrounding objects (its ground).[27]

In a research study testing visual perception, evidence of age progression was found from age three to approximately age seven and a half, with little development occurring after that age. This discovery coincides with Piaget's finding which states that at around age seven cognitive or intellectual operations begin to gain predominance. Educators should note the fact that visual perception development is of great importance to the preschool and primary child.[28]

Classification requires the ability to recognize likenesses and differences and to group them on the basis of these two criteria. This idea is a natural outgrowth of a child's try to make sense out of his surroundings by using the means by which objects of his world are identified.[29] Giving a child the opportunity to learn to see objects in their complexity and in their many operations should provide him with enriching information about his world.[30] As a child learns to classify, he begins to infer such definitions as, "a triangle is" or "_____ is red."[31]

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[27]Frostig and Horne, p. 36.

[28]Frostig, Lefever, and Whittlesey, p. 161.

[29]Evelyn Sharp, Thinking Is Child's Play (New York: E. P. Dutton and Company, 1969), p. 29.

[30]Irving E. Sigel, "The Development of Classificatory Skills in Young Children: A Training Program," Young Children, XXVI (January, 1971), p. 172.

[31]Richard W. Copeland, How Children Learn Mathematics--Teaching Implications of Piaget's Research (New York: Macmillan Publishing Company, 1974), p. 53.

Classification is an intellectual skill in that it lies at the center of certain types of learning.[32] Classification skills are prerequisites to concept attainment and are necessary for problem solving in such subject areas as mathematics, science, and social studies. Items are organized into unified groups and labeled; the formal label is the concept name. Young children can group but may not be able to produce a formal label; these groupings are indicative of classification skills.[33]

Sigel (1971) states that all objects are multidimensional; size, shape, and color are a few of the characteristics which all objects possess. Some attributes are observable or are seen in the physical nature of an object; others are classified on the basis of actions that can be imposed on an object. Each object's characteristic or attribute can be possible criteria by which to make a classification.[34] The first classification experiences a child encounters should be sorting with physical objects.[35] Objects, as investigated, may be classified by such criteria as larger than, the same color as, or with three edges.[36] Since the young child's world is concrete, he can use logic and reasoning in manipulating material long before he can handle verbal problems.[37]

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[32]Sharp, p. 29.

[33]Sigel, p. 171; see also Sharp, p. 29.

[34]Sigel, p. 171.

[35]Sharp, p. 29.

[36]Copeland, p. 53.

[37]Sharp, p. 29.

Piaget and his associate, Barbara Inhelder, identified three phases of classification which children progress through gradually. If a three-year-old is asked to put all blocks of a particular color together, he begins performing the task correctly momentarily and then begins building things with the blocks. Experience is necessary for the child to recognize likenesses among objects and to classify them only on this premise.[38]

Upon reaching the second phase of development, the child is able to put all the blocks of one color in one stack and the remaining ones in another stack. If one observes him, he seems to understand the classification concept, but he really does not. He is still confused if he works with objects that have overlapping qualities. If a child is presented with red squares, blue squares, and blue circles in this phase, he will be able to classify these objects by shape or color.[39] However, he may not comprehend a question such as, "Are all the circles blue?" He would probably say "no" because he knows that all the blue ones are not circles but does not understand that all the circles are blue. A child in this phase does not understand how all of one thing can be only some of another nor does he understand the concept of class inclusion.[40] Class inclusion is attained through experiences in which the child finds various characteristics to guide his groupings and diverse ways to

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[38]Sharp, p. 30.

[39]Ibid.

[40]Sharp, p. 30; see also Ellin Kofsky, "A Scalogram Study of Classificatory Development," in Logical Thinking in Children, by Irving E. Sigel and Frank H. Hooper, eds. (New York: Holt, Rinehart and Winston, 1968), p. 211.

combine the characteristics.[41] Not until around the age of seven or eight, when he grasps this idea, will the child have genuine classification skill.[42]

One may argue that a task requiring the child to verbalize is different from a task requiring manipulation of objects regardless of the similarity of the content. There is further difficulty concerning the unreliability of children's responses. Young children are often not as aware of the need for consistency and, as a result, are not as likely to perform consistently on tasks as adults. Therefore, using a small sample of young children's behavior may not be the most appropriate method for scaling development of various concepts.[43]

During the preschool years emphasis on mathematical ideas by the teacher should be a guiding, question-asking process. Blocks of various geometric shapes can be sorted by color, by shape, or by size.[44] The child should be allowed to explore and find out relationships for himself without being shown or told what to do.[45]

In the preschool years and in primary grades geometry includes the recognizing and naming of regular figures such as triangles, squares, and rectangles.[46] A child may observe a square and yet be unable to

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[41]Sigel and Hooper, p. 211.

[42]Sharp, p. 30.

[43]Sigel and Hooper, p. 222.

[44]Myron F. Rosskopf, "Piagetian Research and the School Mathematics Program," Arithmetic Teacher, 19 (April, 1972), p. 310.

[45]Rosskopf, p. 311.

[46]Copeland, p. 209.

translate this idea into mental representations.[47] If a child is given a triangle and asked to describe it, he may handle it, feeling its straight edges and corners. The knowledge of a triangle that develops from seeing and touching it or by impressions is the child's perception of the object.[48]

Experiments show that perception or seeing a figure is not enough for a child to learn the idea of a shape; there must be physical action by the child on the object.[49] Seeing and telling is not abstracting and understanding. The child must form his own mental structures based on his physical action on the objects.[50] Piaget has concluded that forming mental images or other representation of shape results from the abstracting properties of shapes while the child is handling the object. Although a child learns to perceive objects or shapes in infancy, he has to learn to observe properties such as corners or parallel sides by actively looking for clues in identifying a shape before he can recognize it among similar shapes. He builds up a knowledge of relationships within a shape through memories of his active exploration of it; of course, a relevant vocabulary assists in this knowledge.[51]

Ida Mae Heard, a professor at North Texas State University, conducted a seven-year longitudinal study of kindergarten children from middle class homes. The study attempted to assess such concepts and

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[47]Copeland, p. 232.

[48]Copeland, p. 239.

[49]Copeland, p. 244.

[50]Copeland, p. 246.

[51]Beard, p. 71.

abilities as naming, identifying, and matching geometric shapes and colors through the use of manipulative materials. The results showed no significant difference at the one percent level of probability in the performance of the boys as compared with the girls.[52] Bjonerud of San Francisco State College conducted another study in 1957 and 1960 to assess the arithmetic concepts of one hundred beginning kindergarten children in public schools. The results led the researcher to conclude that the majority of preschool children possess the ability to recognize circles and squares. Ninety-one percent of the children tested could identify a circle and seventy-six percent could identify a square.[53]

In Potter's research conducted in 1949 visual discrimination appeared to be indicative of reading readiness and predictive of first grade reading achievement. In 1958 Goins reported that four tests with visual perception of geometric shapes had fairly high correlations with first grade reading achievement. Both researchers concluded that visual discrimination of geometric figures and pictures as used in their studies seemed to be valid predictors of achievement in first grade reading.[54]

Cook (1931) found that children are able to discriminate colors early, even before they can verbally label them. He reports that more

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[52]Ida Mae Heard, "Mathematical Concepts and Abilities Possessed by Kindergarten Entrants," Arithmetic Teacher, 17 (May, 1970), p. 218.

[53]Corwin E. Bjonerud, "Arithmetic Concepts Possessed by the Preschool Child," Arithmetic Teacher, 7 (November, 1960), p. 350.

[54]Thomas C. Barrett, "Visual Discrimination Tasks as Predictors of First Grade Reading Achievement," The Reading Teacher (January, 1965), p. 276.

two-year-olds can match colors than can name them. By around four years of age, approximately ninety percent of the children could match colors and eighty percent could name them.[55]

Dale (1969) states that young children describe color terms in an appropriate manner. Four-year-olds usually give a one-word name to colors when asked to describe them. Remembering color names is sometimes difficult for four-year-olds; therefore, color matching tasks seem to be simple since no memory is involved.[56]

A study by Gesell (1940) dealing with color naming found that twenty-six percent of the four-year-olds used named no color and twenty-two percent named at least three of the primary colors. Frankenburg and Dodds (1967) used the Denver Developmental Screening Test and reported that the primary colors were identified by twenty-five percent at 2.7 years old; fifty percent at 3.0 years; seventy-five percent at 3.7 years; and ninety percent at 4.9 years.[57] Anyan and Quillian (1971) reported that between ages three and four, girls named the primary colors more accurately than boys, but no statistically significant differences was computed.[58]

Piaget's studies of language and thought have taught educators to be curious about determining what a child knows or understands from

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[55]Hoffman and Hoffman, p. 230.

[56]Philip S. Dale, "Color Naming, Matching, and Recognition by Preschoolers," Child Development, 40 (1969), p. 1136.

[57]Walter R. Anyan, Jr., and Warren W. Quillian, "The Naming of Primary Colors by Children," Child Development, 42 (November, 1971), p. 1629.

[58]Anyan and Quillian, p. 1631.

observing his actions or speech.[59] Piaget believes language and thought are two closely related but different systems. Language is an aid but it is not enough by itself to bring about the mental operations necessary for systematic thought.[60] A child may not have a corresponding concept simply because he can say the word for it or can perform some action that seems to reflect its use.[61] Through the use of intelligence tests, psychologists have found that readers' verbal fluency masks inadequacies in concepts and skills that are equally important.[62]

Some theories state that language is the main determinant in the developmental order of concept development and thought. Brown (1958) and Whorf (1956) found that some languages do not include certain categories that describe a particular situation or relationship. Therefore, the accessibility of categories can even be said to be determined by language structure. Acquiring language and the linguistic system one uses are important factors in determining the types of concepts a child will develop. Johnson (1962) concluded that language structure influences how one organizes and understands the surroundings. From this viewpoint language acquisition determines how environment is discriminated, which objects can be integrated, and what kinds of abstract concepts can be invoked. However, the exact role of language is still being studied.[63]

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[59]John Downing, "The Child's Concept of Language" (July 31, 1973), ED 094 372, p. 1.

[60]Sharp, p. 45.

[61]Downing, p. 2.

[62]Beard, p. 74.

[63]Hoffman and Hoffman, p. 223.

According to Smilansky (1860), children need to have experience with language diversity; they need to hear language used and to use language themselves for communicating with others, for telling about what they are experiencing, and for moving beyond their present experience to plan and organize activities.[64] As a child discovers things for himself, he wants to describe them, talk about them, and ask questions about them. He wants a name for each object he handles; he wants to tell people what he is doing, how he feels, and what he thinks.[65] A. R. Luria in The Role of Speech in the Regulation of Normal and Abnormal Behavior (1961) described language as the necessary way by which children find their bearing in the outside world.[66]

Language factors have been reported to account for differences in scores on achievement tests in many investigations. In two separate studies Ryckman (1967) and Haring and Ridgeway (1967) found that general language ability accounted for a certain percentage of the variance in intellectual functioning test scores of 100 kindergarten children. Language definitely affects the child's capacity to benefit from learning opportunities in school. A child's language abilities are especially important in experiences that call for verbal performance and theoretical reasoning, which is the case in most school situations.[67]

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[64]Rose M. Bromwick, "The Young Child's Language and Effective Learning," Elementary English, 49 (October, 1972), p. 828.

[65]Lois B. Murphy and Ethel M. Leeper, The Ways Children Learn (United States Department of Health, Education, and Welfare, 1974), DHEW Pub. No. (OHD) 75-1026, p. 7.

[66]Bromwick, p. 829.

[67]Margaret Faust, "Cognitive and Language Factors," The Journal of Special Education, 4 (Summer, 1970), p. 339.

Children's verbal language may provide a medium for studying their thoughts and perceptions.[68] Havighurst (1952) stated that acquiring language skill is one of several developmental tasks that must be mastered early in life or the child will suffer for his failure in later years. Stodolsky (1965) concluded that a minimum level of language development is necessary, but not enough, for the child to reach a high conceptual level.[69]

In performing research studies with language usage, one problem is keeping the child's attention for a long enough time period to obtain sufficient data. Another difficulty encountered is getting children to respond to a specified set of research stimuli. A further problem is eliciting language responses which are unstructured or free-flowing.[70]

Jeremy D. Finn (1969) conducted a study to determine the extent to which it is possible to understand young children's perceptions of their world through studying their language responses. The way a child perceives his surroundings and the aspects of it that he feels are important can be understood by noting the recurrence of a particular theme in the verbal language of a child. One must remember that there may be significant differences in a child's perceptions of his world from situation to situation. Bernstein (1962) states that there is a relationship between the effects of a particular situation on the child's language and on outward behavioral procedures. Using this relationship,

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[68]Jeremy D. Finn, "Patterns in Children's Language," The School Review (June, 1969), p. 108.

[69]Finn, p. 109.

[70]Ibid.

some thought processes of which observed language patterns might be suggestive can be theorized.[71] Finn's study showed that samples of unstructured, free-flowing language from young children can give insight into how a child perceives his world and how the environment is helpful in structuring his language responses.[72]

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[71]Finn, p. 122.

[72]Finn, p. 123.

Chapter III

DESIGN OF THE STUDY

Rationale

The rationale underlying the design of the present study was that of controlling for as many variables as possible while choosing children whose ages alone were the primary differentiating factors. The children in the study are from the same general background as indicated by socio-economic factors. They were exposed to the same school environment, the same teaching staff, and the same play and instructional materials. The questionnaire used in this study was designed by the author; a copy is included in Appendix A.

Sample

The sample for this study includes children who were enrolled in an early childhood program that generally includes children who are three and four years old. The program is located at the Lucy Brock Nursery School at Appalachian State University, Boone, North Carolina. Parents are required to pay a set fee to enroll their children in the nursery school.

The Lucy Brock Nursery School is a university laboratory setting in the Department of Home Economics. The program is utilized as a training center for studying child development and learning. The nursery school is an open-styled program with a balance between teacher-planned activities and many opportunities for the children to explore the

environment independently. The program provided extensive opportunities for these children to have prior experience with shapes and colors. Planned activities and various games afforded numerous chances for the children to perceive and play with colors and shapes. Also, since most of the children came from homes with professional parents, exposure to these concepts probably began at home.

Eight children were selected from among the twenty enrolled in the program. From these eight children four four-year-olds and four three-year-olds were chosen. Within each group of four, two boys and two girls were selected for comparison purposes. The children were divided by age and sex; from these groups eight were chosen by the random sampling technique.

Testing Procedures

An appropriate method was needed in order to afford some means of measuring the conceptual knowledge in the identification of shape and color. Each child was asked the same basic questions (see copy in Appendix A) in individual, taped interviews and was encouraged to respond as fully as he or she wished or was able to respond. The questions were designed to motivate responses that would indicate whether there were measurable evidences of conceptual learning in the identification of shapes and colors and to what extent the child would be able to express himself or herself in regard to his or her knowledge of the two categories.

The testing was conducted in a corner somewhat divided from the rest of the classroom. The author tested each child and recorded responses for use in the study.

In this investigation there was no formal teacher instruction related to the tasks other than the usual exposure to shapes and colors that children might experience. The children used different colored construction paper cut-outs to identify color. Regular geometric shapes were avoided in order to prevent confusion with the identification of shape. A total of twenty cut-outs were placed on a table in front of the child during testing. The cut-outs were designed so that there were five of each color.

Natural-colored, wooden shapes, one-eighth inch in thickness, were used for the identification of shape; a natural color was used to prevent confusion with the task of color identification. Twenty figures, five of each shape, were placed on the table for the children to use during testing. A common variety of solid wooden building blocks was used in the shape test for matching purposes.

The children's responses to the questions were assigned numbers so that the investigator could check carefully to evaluate the children's degree of conceptual understanding about shapes and colors, as expressed through their language. (See copy of numbered responses in Appendix B.) The nature of language used by the children is discussed in the concluding chapter of this study.

Analysis of the Data

A statistical method was needed by which performance data collected during the investigation could be analyzed to determine whether or not there were any significant differences in the children's responses.

The chi-square analysis was determined to be an appropriate test to measure for any significant differences that might be found in the study.[73]

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[73]N. M. Downie and R. W. Heath, Basic Statistical Methods (New York: Harper and Row, Publishers, 1959), p. 198.

Chapter IV

FINDINGS OF THE STUDY

To determine whether or not evidences of conceptual knowledge were shown by the subjects, mean scores were calculated from responses to questions concerning shape and color. The mean for the color test was computed to be 3.15. (See Appendix B.) On the basis of the numbered responses this value corresponds to "did the task with hesitation and without error." This finding fails to support that part of the hypothesis which states that evidences of conceptual knowledge concerning colors will not be found in the subjects' responses.

The mean for the shape test was calculated to be 1.85. (See Appendix B.) This value corresponds to the numbered response meaning "did the task with hesitation and with no more than two errors." This finding suggests that evidences of conceptual knowledge concerning shape were not found in the interview responses; therefore, on the basis of this finding, the author accepts that part of the hypothesis which states that evidences of conceptual knowledge of shapes will not be found in the subjects' responses.

The results of testing are presented in Table I. When analysis of the data was attempted using the chi-square test, several cell expected frequencies were found to be two or less. Thus, in order to utilize a chi-square analysis, several cells had to be combined for

Table I

Results of the Shape and Color Test by Age

	Three-year-olds		Four-year-olds	
	Shape	Color	Shape	Color
No effort	3	6	6	2
With hesitation and more than 2 errors	5	1	8	1
With hesitation and no more than 2 errors	9	4	3	5
With hesitation and no error	1	4	3	5
Without hesitation and without error	6	15	4	11

computational purposes.[74] The results of these combinations are presented in Tables II and III along with the chi-square results.

For Table II the degrees of freedom were three and the chi-square value was 4.691. A chi-square value of 7.815 is required for significance at the five percent level. Thus, the null hypothesis of no difference between the age groups on the shape test was accepted. Therefore, the shape test showed no statistically significant difference between three- and four-year-olds.

The degrees of freedom for Table III were also three. The chi-square was found to be 1.838. A chi-square value of 7.815 is required for significance at the five percent level. Thus, the null hypothesis

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[74]N. M. Downie and R. W. Heath, Basic Statistical Methods (New York: Harper and Row, Publishers, 1959), p. 198.

Table II

Adjusted Results of the Shape Test by Age

	Three-year-olds	Four-year-olds
No effort	3	6
With hesitation and more than 2 errors	5	8
With hesitation and no more than 2 errors	9	3
With hesitation and no errors and without hesitation and without error	7	7

$X^2 = 4.691$

Table III

Adjusted Results of the Color Test by Age

	Three-year-olds	Four-year-olds
No effort and with hesitation and more than 2 errors	1	3
With hesitation and no more than 2 errors	4	5
With hesitation and no error	4	5
Without hesitation and without error	15	11

$X^2 = 1.838$

of no difference between the age groups on the color test was accepted. There were no statistically significant differences between the three-year-olds and four-year-olds on the color test.

One child was reluctant to answer the questions concerning shapes. Because of the low responses recorded for the child and the small sample size, a revised analysis of the data was done, omitting the data for this particular subject. The data for the revised analysis is recorded in Tables IV and V.

Table IV

Revised Analysis of the Results of the Shape Test by Age

	Three-year-olds	Four-year-olds
No effort	3	2
With hesitation and more than 2 errors	5	7
With hesitation and no more than 2 errors	9	3
With hesitation and without error and without hesitation and without error	7	6

$x^2 = 4.618$

Using the same degrees of freedom and the same value for significance at the five percent level, the calculations produced the same findings. No significant differences were found between the three- and four-year-olds concerning the conceptual knowledge of shape and color.

Although no hypothesis was made comparing responses on the basis of sex, the chi-square was computed to determine whether or not any

Table V

Revised Analysis of the Results of the Color Test by Age

	Three-year-olds	Four-year-olds
No effort and with hesitation and more than 2 errors	1	2
With hesitation and more than 2 errors	4	5
With hesitation and without error	4	3
Without hesitation and without error	15	8

$X^2 = 1.853$

significant differences would be found between males and females. A chi-square of 18.856 was calculated for the shape test which, with three degrees of freedom, is significant at the one percent level. Boys were found to respond more accurately to the questions asked about shapes. A chi-square of 9.081 was obtained for the color test which, with three degrees of freedom, is significant at the five percent level. In examining the data for this study, girls were found to have a better knowledge of color than boys.

Chapter V

CONCLUSIONS AND DISCUSSION

This study attempts to measure the conceptual knowledge of three- and four-year-olds with regard to shape and color identification. On the basis of findings in this study, the author concludes that evidences of conceptual knowledge concerning color is found in three- and four-year-olds. However, evidences of conceptual knowledge concerning shape was not found. There were no statistically significant differences found between three- and four-year-olds with regard to knowledge of shapes and colors.

The findings in this study may have occurred for several reasons. Boys may have performed better on the shape test due to their extensive block play. Through their manipulation of these materials they may gain a better knowledge of shapes. Girls showed statistically better performance on the color test. A possible reason for this finding could be that girls have greater exposure to color through wearing more colorful clothes than male peers. Also, they tend to dress up in their mothers' colorful dresses which further exposes them to color. Finding no significant differences between the age groups on either of the tests may be due to the closeness of the children's ages (three- and four-year-olds).

The author's relationship with the children during the previous nine months was one of a teacher in the classroom. This fact helped the author to establish a rapport with the children such that the testing

raised minimal anxiety among the children. The testing procedure also allowed for some children to express a wide variety of ideas and concepts related to their own experiences. For example, two of the three-year-olds responded extremely well in naming objects of a particular shape or color outside or at their homes. Their verbalizations showed much insight in relating their prior experiences to these two concepts. Several of the children did not draw on their experiences to answer the questions and so did not respond to that particular question.

A few of the children became inattentive toward the end of the session. There are a couple of possible reasons for this occurrence. The instrument may have taken too long a time period in relation to their attention span; this reason is doubtful since the total time was fifteen to twenty minutes, and a majority of the children responded enthusiastically. Another possible reason may be that the children did not know a response so they walked around or were reluctant to participate.

Often the children would not verbally respond to the questions but would point to their response. Despite repeated encouragement by the investigator to verbalize their answers, the children persisted in the pointing response. A few of the children suddenly interrupted the questioning with language unrelated to the questions. They told about some experience they had had or were going to have or asked about the tape recorder. This type study allows the researcher to discover much about language development in young children by listening carefully to their responses.

Recommendations

Recommendations for additional research in the same general area as the present investigation are:

1. Use of broad samples of children from many different socio-economic levels.

Replication of the present study with a sample of children from various socio-economic levels would be useful in determining the conceptual development, as described in this study, of children from other backgrounds.

2. Use of sample of children from many different racial or cultural groups.

Using different racial and cultural groups would aid in comparing the conceptual knowledge of children in this age group.

3. Replication of the study with other age groups.

The selection of specific age groups from children with beginning language skills among a large sample of children would help in the assessment of language ability and conceptual knowledge at various age levels.

4. Study of other skills related to conceptual development.

The present study was devoted to an exploration of young children's knowledge of shape and color. Research should be extended to include a wider range of related skills.

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APPENDIX A

INSTRUMENT USED IN THE STUDY

Shapes

1. What shape is this? (Point to a shape.)

2. Find me a _____. (Name triangle, circle, square, rectangle from these shapes.)

3. Can you think of or find something in the room that is shaped like a _____? (Triangle, circle, square, rectangle)

4. Can you find me a block that looks like that? (Point to a shape.)

5. Put all the _____ in one stack. (Name a shape.)

6. Can you think of some more things that are shaped like _____--maybe at your house or outside? (Name a shape.)

Colors

1. What color is this? (Point to red, yellow, blue, green, orange, or purple.)

2. Find me a _____ cut-out in this stack. (Point to a color.)

3. Can you think of or find something in the room that is _____? (Name a color.)

4. Put all the _____ cut-outs in one stack. (Name a color.)

5. Can you find me something in the room that is the same color as this cut-out? (Point to a cut-out.)

6. Can you think of some more things that are _____? (Name a color.)

Language

1. Does the child use:

   a. body language ____
   b. one-word answers ____
   c. complete sentences ____

2. Does the child use descriptive words and elaborate about his answers? Note examples on tape.

APPENDIX B

Numbered Responses for Each Child
on the Shape and Color Tests

Shape Test

Question	Three-year-olds				Four-year-olds			
	A	B	C	D	A	B	C	D
1	1	2	2	4	1	3	1	0
2	1	2	2	4	1	4	2	0
3	1	2	1	3	1	1	2	0
4	4	4	2	4	3	4	3	4
5	2	2	2	4	1	4	0	1
6	1	0	0	0	1	0	2	0

Mean = 1.85

Color Test

Question	Three-year-olds				Four-year-olds			
	A	B	C	D	A	B	C	D
1	2	4	4	4	1	4	4	4
2	2	4	4	4	2	4	4	3
3	3	4	4	4	2	3	3	4
4	2	4	4	4	2	4	4	4
5	3	3	4	4	2	4	4	3
6	1	2	4	3	2	0	3	0

Mean = 3.14

Numbers Assigned to Responses on Instrument

0 - No effort

1 - Did the task with hesitation and with more than two errors

2 - Did the task with hesitation and with no more than two errors

3 - Did the task with hesitation and without error

4 - Did the task without hesitation and without error

APPENDIX C

Ages of Subjects
(at beginning of study)

Three-year-olds	Age
A	3 years 10 months
B	3 years 6 months
C	3 years 10 months
D	3 years 6 months
Four-year-olds	**Age**
A	4 years 5 months
B	4 years 7 months
C	4 years 6 months
D	4 years 3 months