CHILDREN'S CONCEPTS OF GENERAL DIVISIONS OF TIME, HISTORICAL TIME, AND TIME AND THE LIFE CYCLE

By

JUDITH ANNE JOURDAN POWELL

Bachelor of Science
Southeastern Louisiana University
Hammond, Louisiana
1963

Master of Home Economics
Colorado State University
Ft. Collins, Colorado
1967

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Thesis Approved:

Josephine Hoffer
Thesis Adviser

Thomas C. Norman

Lamar Heaston

Frances Stromberg

N. N. Durham
Dean of the Graduate College

902211

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CHAPTER I

THE PROBLEM AND ITS IMPORTANCE

Time and change are two of the fundamental concepts involved in mathematics, science, and history. Lovell (1961) has indicated that an understanding of time is essential to the understanding of such concepts as velocity, distance, and acceleration per unit time, all of which frequently occur in mathematical and scientific study. Craig (1958) listed both time and change as two of the seven essential concepts in the science education of young children: (1) The universe is very large--Space; (2) The earth is very old--Time; (3) The universe is constantly changing--Change; (4) Life is adapted to the environment--Adaptation; (5) There are great variations in the universe--Variety; (6) The interaction of living things--Interrelationship; and (7) The interaction of forces--Equilibrium and Balance.

Despite the importance of concepts of time and change in daily living and in educational attainment, surprisingly little is known about the development of young children's concepts of time and change. There is no agreement in the literature concerning whether historical time concepts are within the realm of young children's understanding. A number of studies have placed the appearance of an historical time concept well beyond the early childhood period (Harrison, 1934; Friedman, 1944). Others indicated that young children can indeed develop some concept of another point in time and another world existing in another geological

era (Wann, Dorn, and Liddle, 1962; Gorman, 1968; Todd and Heffernan, 1970). While it has been generally agreed that young children cannot grasp history in its chronological sense, there is a growing acceptance of the idea that the preschool child can begin to develop an understanding of the "structure" of history. Modern means of transportation and mass media have brought the "far away in time and space" into the consciousness of young children. This exposure to a mixture of time and places may be confusing, but it may also be educational. Children can no longer be unaware of historical changes even though understanding of more detailed chronological change must come more slowly with further experience. In his classic text on the elementary school science curriculum, Craig (1958) indicated that even very young children can understand that the events of today soon become those of yesterday and that just as things happened yesterday, last week, last month, or last year, so there are events that took place thousands or millions of years ago.

A number of investigators have indicated that the validity of earlier studies on children's concepts of time and change may be open to question in relation to present-day children. A study by Gorman (1968) indicated that the responses of 187 children, ages four through twelve, revealed a greater breadth of awareness of several aspects of time than previous studies. No limitations were found which indicated a need for postponing instruction designed to foster historical time concepts. According to Weaver (1965), young children can begin to understand the concept of change as they explore the community for signs of change over periods of time. Young children can be led to see that the study of history involves the interpretation of change. He cautioned that at this point in young children's learning, dates are unimportant, but an

understanding of the ways in which people once lived is possible and worthwhile for young children. Weaver concluded that ways need to be found to provide children with meaningful experiences to help them become aware of their cultural heritage and their unique place in history.

Chisholm (1968) pointed out that much of the important work being done in this changing world requires people with a true time perspective, people who can function in terms of future generations, doing constructive work which they realize will not benefit the present generation, but is calculated to begin or encourage progress which will bear fruit in the future. He maintained that the key to developing people with this kind of perspective was the education of young children. Chisholm suggested that a true concept of reality was needed, and basic to that is learning about time and space. He further suggested that children must learn about: (1) life in its early forms, competing for survival and evolving in many directions; (2) later forms of life, adjusting to changes or disappearing, and (3) latest forms of life. Chisholm considered an understanding of biological reproduction, growth, and development as essential components of the education of young children.

Regardless of the complexity of time concepts, several studies have documented children's attempts to understand concepts of time and change. Wann, Dorn, and Liddle (1962) reported numerous recordings of children's attempts to straighten out and use the designations of time, e.g., hours, days, weeks, years. Incidents of struggles with "yesterday" and "tomorrow" as means of discussing time were also reported. Robison and Spodek (1965) cited examples of preschool children being able to identify ships from a previous era even though their knowledge of history

was scanty. They could not relate to a particular era or event in history, but they knew that the ships were old-fashioned in some way. This represented a beginning step toward a grasp of the significance of change which has taken place through time.

Since young children want to know more about time, the events of the past, and the changes which occur in plants, animals, and people over periods of time, it can be concluded that additional research is needed to identify what children can understand about concepts of time and change and to plan for ways to help them increase their understanding. Many curriculum resources for teachers of preschool children include learning experiences purported to help children understand the concepts of time and change. However, there is no indication that those experiences have been designed on the basis of empirical evidence of what young children can understand about these subjects. Robison and Spodek (1965) cautioned that programs for young children must be based in part on what children know. Before new programs are instituted in the classroom, teachers need to appraise the skills and understandings which children have. Most of the studies of young children's concepts of time were completed in the 1940's and 1950's (Ames, 1946; Piaget, 1946; Bradley, 1948; MacLatchy, 1951; Springer, 1952), and they relied heavily upon the child's verbal responses or completion of paper and pencil tests. Because of the difficulty with which young children express their understandings by verbalization only, the results of these studies are open to question when applied to preschool children. Consequently, an instrument utilizing appropriate tasks in addition to verbalization is needed in order to determine young children's concepts of time and change.

The Purpose of the Study

The overall purpose of this study was to determine young children's concepts of time and change as related to: (1) General Divisions of Time, (2) Historical Time, and (3) Time and the Life Cycle. Specific purposes were to:

1. develop an instrument, the Time Understanding Test (TUT), to determine young children's concepts of General Divisions of Time, (2) Historical Time, and (3) Time and the Life Cycle;
2. determine the relationship between preschool children's chronological age and their concepts in each of the selected areas, i.e., General Divisions of Time, Historical Time, and Time and the Life Cycle;
3. determine the relationship between preschool children's sex and their concepts in each of the selected areas, i.e., General Divisions of Time, Historical Time, and Time and the Life Cycle; and
4. determine the relationship between children's understanding of one aspect of time and change and other aspects of time and change.

Hypotheses

In order to expand our knowledge of young children's concepts of time and change and to increase effectiveness in planning appropriate learning experiences for young children, the following null hypotheses

were examined:

1. There is no significant difference in young children's concepts of General Divisions of Time as measured by scores on the TUT according to: (a) age, (b) sex, (c) age and sex.
2. There is no significant difference in young children's concepts of Historical Time as measured by scores on the TUT according to: (a) age, (b) sex, (c) age and sex.
3. There is no significant difference in young children's concepts of Time and the Life Cycle as measured by scores on the TUT according to: (a) age, (b) sex, (c) age and sex.
4. There is no significant difference in young children's concepts of time and change, as reflected in their total TUT scores, according to: (a) age, (b) sex, (c) age and sex.
5. There are no significant relationships between General Divisions of Time, Historical Time, and Time and the Life Cycle as conceptualized by young children.

Definition of Terms

General Divisions of Time

This category was first defined by Ames (1946) to include children's understanding of "morning and afternoon," "day," "time," "month," "seasons," and "year." For the purposes of this study, the term "General Divisions of Time" includes children's concepts of "day and night," "yesterday, today, and tomorrow," "days of the week," "month," "year," and "seasons of the year."

Historical Time

This category has been defined by Forer (1970) and Gorman (1968) to include the child's ability to understand that which happened in the past, including both subjective time as it is related to the child's own personal life and objective time as it is related to external societal time.

Time and the Life Cycle

This category is based on Gorman's (1968) category, "Change-Development, Aging, Life-Span." As adapted for this study, it includes children's concepts of the life cycle of humans, animals, and plants. This category includes children's ideas about their own existence in time and their own growth processes, as well as changes which take place in living and non-living things in the world around them.

CHAPTER II

RELATED LITERATURE

Development of Time Concepts

A number of investigators have studied the process by which young children develop concepts of time and change (Harrison, 1934; Ames, 1946; Farrell, 1950; Freud, 1950; Piaget, 1954; Bernstein, 1955; Forer, 1970). Freud (1950) and Piaget (1954) have proposed that time concepts appear to develop in a sequence of three stages: (1) Egocentric Time, (2) Subjective-Personal Time, and (3) Abstract Time. Egocentric Time is related to the physiological needs and frustrations of the infant and toddler. Subjective-Personal Time is related to the events that fill time for each individual, including concepts of night and day, change of seasons, and recognition of time units, such as seconds, hours, and months. Abstract Time is related to the child's ability to become objective in relation to the outside world and society's way of dealing with time. According to these investigators, this final stage allows the child to coordinate a more abstract view of time, and he begins to operate on a hypothetical proposition rather than being constrained by what he has experienced or what is before him. Farrell (1950) suggested that time concepts are developed through indirect perceptual experiences. The child has a number of experiences, perhaps unrelated in themselves, which have the common factor of time. On the basis of these experiences,

the child extracts time concepts and gradually develops abstractions or understandings of time.

Research on the understanding of time was summarized by Schecter, Symonds, and Bernstein (1955), who divided the children's development of time concepts into seven stages: (1) past, present, and future; (2) diurnal rhythm; (3) seasonal rhythm; (4) age; (5) days of the week; (6) months of the year; and (7) clocks and telling time. These stages generally agree with the developmental sequences of time understanding described by Freud (1950) and Piaget (1954), i.e., the development of children's concepts of time proceeds from concrete to abstract, physiological to interpersonal, and private to social.

Harrison (1934) discussed the following factors as important in the development of time concepts: (1) understanding of the concepts of number; (2) mental development; and (3) chronological age. She measured degree of comprehension of time concepts by testing 160 children in kindergarten through third grade on their understanding of 50 commonly-used time terms. Data were interpreted to indicate that development of time concepts was closely related to grade and intelligence. Harrison concluded that the intellectually bright child was able to generalize subjects and abstract regular time concepts much earlier in his development than the average or slow child. In a study comparing the time concepts of normal achieving children with educationally handicapped (EH) children, Forer (1970) concluded that in normal children there was a consistent improvement in performance on an author-developed instrument, the Time Understanding Inventory, with increasing age. The difference in performance with respect to cognitive and perceptual time understanding decreased with age, suggesting that perceptual concepts of time

were mastered earlier than intellectual concepts. These findings were consistent with results of other studies which suggested that younger children rely on perceptual cues in their understanding of time, whereas older children are able to integrate the more intellectual aspects of time understanding.

The most comprehensive early study of the development of children's time concepts was done by Ames (1946). For two years, she observed children from 18 to 48 months of age and recorded spontaneous verbalizations involving time or implying time expressions. The observations were followed up with a series of questions dealing chiefly with various aspects of the concept of time. In regard to the development of children's time concepts, she concluded that:

> First, the child is able to respond suitably to a time word; next he is able to use it himself in spontaneous conversation; and lastly he is able to answer questions dealing with the concept. Thus, a child responds, by waiting, to the phrase, 'Pretty soon' at 18 months; he uses the phrase himself spontaneously at 24 months; and at 42 months he can answer the question, 'When is mommy coming for you?' by the answer, 'She'll come pretty soon' (p. 115).

Ames also reported many examples of children comprehending and using expressions denoting the specific before they could comprehend and use expressions denoting the general. For example, "time" is used by children in such specific contexts as "wintertime," "lunchtime," "puzzletime," when they use it initially. Only much later do phrases such as "When it's time," "Our time is over," and "Do we have time?" come in. One of the most significant findings of Ames' study was the marked individual difference which appeared in different children's orientation in time. Some children appeared to have excellent orientation and expressed free and elaborate use of time words from a very early age,

while others showed almost no orientation in time. Ames concluded, first, that readiness to acquire and exercise time concepts depended chiefly upon maturational factors, and, second, that there existed an underlying growth and a patterning process. A limitation of Ames' study is that she did not distinguish between the child's use of time words and the child's understanding of time concepts. It may have been more accurate for Ames to have spoken of children's acquisition of a time vocabulary rather than of time concepts.

General Divisions of Time

A number of investigators have studied the development of children's concepts in the area of General Divisions of Time. These studies have been primarily concerned with the development of the ability to identify the following: (1) day and night; (2) yesterday, today, and tomorrow; (3) days of the week; (4) month, year, and season of the year; and (5) clocks, calendars, and the ability to tell time.

Day and Night

In studies of young children's concepts of "day" and "night," it was found that children first characterized "day" and "night" in terms of activities such as "when you have breakfast" and "when the lights are out." With increasing age, there was a shift from immediate personal experience, e.g., sleeping and eating, to the beginning of comprehension that there is an external cyclical scheme which is not dependent on personal experiences. New external criteria used by five-year-olds were, "At night the planets shine," and "At night the sun goes down and it gets dark" (Schecter, Symonds, and Bernstein, 1955; Gorman, 1968).

Eleven of 14 nine- and ten-year-olds interviewed in depth by Gorman (1968) knew that the diurnal cycle of daylight and darkness was related to the movement of the earth or the sun. Eight of these same children thought that it could be any day in different parts of the world, and some of them thought it could be different months or different years in different parts of the world.

Yesterday, Today, Tomorrow, and Day of the Week

Previous research has generally found that children first used words dealing with the present, then the future, and finally the past. Children were able to tell what they will do tomorrow before they can tell what happened yesterday (Ames, 1946; Schecter, Symonds, and Bernstein, 1955).

Although memorizing the days of the week is a common practice in preschools and kindergartens, little is known about children's ability to identify days of the week. In a study of 108 kindergarten children, 94 percent could identify Sunday as a day of the week; 85 percent could identify non-school days; 67 percent could name all the days of the week in order; but only 59 percent could identify which day "today" actually was (Spayde, 1953). Other research indicated that six-year-olds were just beginning to define "yesterday" and "tomorrow" in terms of days of the week, e.g., "Yesterday was Tuesday," (Schecter, Symonds, and Bernstein, 1955).

Month, Year, and Season of the Year

Research in this area has revealed that children have a tendency to

classify time in terms of specific holidays before seasons of the year. Identification of holidays and seasons has been found to be within the ability of preschool children, although there is little agreement about the specific ages at which these abilities occur. In her study of over 200 preschool children, Ames (1946) suggested the following sequence: (1) Christmas, at three years; (2) Easter, at three and a half years; (3) Halloween, at four years; and (4) Thanksgiving not before five years. With regard to seasons of the year, Ames suggested the following sequence: (1) Winter, by three years; (2) Summer, by three and a half years; (3) Spring, by five years; and (4) Fall, by six years. Although later studies tended to confirm Ames' findings with regard to the order in which children develop concepts of seasons, they disagreed with regard to the chronological age at which each concept might be expected to appear. In a study of 73 preschool children, MacLatchy (1951) found that three-year-olds did not know the seasons. Eleven of 19 four-year-olds knew the seasons, being able to describe winter and summer before fall and spring. Using MacLatchy's interview questions, Spayde (1953) found that of 108 kindergarten children, 84 percent could name and describe winter; 85 percent could name and describe spring; 67 percent could name and describe fall; and 69 percent could name the current season. Only six-year-olds in Schecter, Symonds, and Bernstein's study (1955) knew the names and sequences of the seasons. Three-year-olds described winter and summer in terms of the weather and activities characteristic of them. Four-year-olds recognized pictures of winter and summer only.

Sturt (1925) made the following observation concerning children's

conceptions of the seasons of the year:

> The season seems to children much less a mark of time than a description of concrete material things that enter directly into their experience. Winter really means snow, or spring, flowers. Consequently, a wrong season may be given with the right description; on a very warm March day, the question 'What season is it?' may produce such an answer as 'Summer, because it is hot' (p. 51).

Although the marking of a monthly calendar is a common activity in many groups of young children, research in the 1940's and 1950's indicated that almost no three- and four-year-olds and only a few five-year-olds knew the month or year. Ames (1946) found that 30 to 33 percent of five- and six-year-olds could name the current month, and only 30 percent could name the year. MacLatchy (1951) reported that only a "few" of the five-year-olds in her study were able to name the month and year. Schecter, Symonds, and Bernstein (1955) observed that many of the threes and fours and most of the fives and sixes knew their birthday month, but fewer than half of all the threes, fours, and fives knew the current month at its inception. As the month progressed, however, most five-year-olds knew what month it was. Only a minority of five-year-olds knew what the current year was. In a cross-sectional study of 697 children from kindergarten through sixth grade, Friedman (1944) found that no kindergarten pupil in the study knew what year it was. Characteristic of the earlier studies in the 1940's and 1950's, actual data upon which the above conclusions were based were not reported.

In a more recent, documented study of 233 preschool children, Wann, Dorn, and Liddle (1962) made numerous recordings of children's attempts to straighten out and use terms such as "hour," "day," "week," and "year" but none in which children used the term "month."

Clocks and Calendars and Telling Time

While earlier studies confirmed that preschool children are able to identify clocks and calendars and to tell their use (MacLatchy, 1951; Springer, 1951; Spayde, 1953), studies of young children's ability to use clocks to "tell time" are inconclusive. According to Schecter, Symonds, and Bernstein (1955), six-year-olds were adept at telling time and showed an interest in the subject. Woody (1931) investigated the ability of kindergarten and primary-age children to tell time. Children were asked to tell time from a clock face which showed "nine o'clock," "one o'clock," "twelve o'clock," and "three-thirty." Subjects were also asked to place the hands on a clock to show "seven o'clock," "five o'clock," "ten o'clock," and "eleven forty-five." Mean percentage of correct responses for all children in kindergarten and the first semester of first grade was approximately 25 percent; children in the second half of first grade and the beginning of second grade had 39 percent correct responses. The investigator concluded that tasks involving reading of time on the clock were easier than tasks involving setting time on a clock. Springer (1951) interviewed 89 children aged four to six years in her study of the ways in which children understand clock time. She concluded first, that the child tells time of activities in his regular schedule; second, that he is able to tell time by the clock; third, he is able to set the clock at a specific time, and fourth, that he is able to explain both the purpose of the two clock hands and how each operates to indicate hours and minutes.

Gorman's research (1968) revealed much of the confusion and misconceptions of older children about "telling time." He conducted

in-depth interviews with nine- and ten-year-olds who could each tell time and answer correctly selected questions about clocks and calendars from previous research studies on "telling time." The children knew the number of seconds in a minute, the number of minutes in an hour, the number of hours in a day, and the number of days in a week. They could name the days of the week and the months of the year in order. According to Gorman, even though these children were quite confident that they knew all there was to know about our time system, he discovered many gaps in their understanding. Some of the children in his study tended to think of time as a tangible reality, a physical force which moved the hands of clocks and wore out both living and non-living things. They thought that our time system was part of the natural order of the universe. Time was thought to be a physical force which encircled the earth as an invisible cloud. It was thought to be similar to gravity in that although time could not be seen, its effects could be observed. For example, some children said they could see the wrinkles that time puts into a person's skin. Several children suggested that there was a "master o'clock" somewhere out in space which kept clocks at the right time. The children assumed that clocks and watches indicated the correct time unless they were broken.

Based on the evidence of earlier studies with preschool children and on Gorman's conclusions about the misconceptions of older children who could all "tell time," it can be concluded that "telling time" for preschool children is likely to be no more than rote dial reading. Since the purpose of this study was to investigate children's concepts about time and change, a study of their ability to "tell time" was not included.

Historical Time

Most investigators place the development of historical concepts of time well beyond the preschool years. An early study in England by Oakden and Sturt (1922) employed a series of written group tests to obtain information which would indicate the age at which the study of history could most profitably be instituted. The first test contained three questions pertaining to time: (1) Robin Hood was alive in 1187. Would your mother be alive then? (2) Would your grandmother? (3) Would Christ be alive then? The test was administered to 110 children from four to ten years of age. Most children, including 50 percent of the four-year-olds, knew that their mother had not been alive in 1187, but they were less sure about their grandmother. The authors explained that inconclusive results had been obtained from the question of whether Christ had been alive at the time of Robin Hood because many of the children had been taught that Christ lives eternally. On the basis of the results of these questions, the investigators concluded that children below the age of eight had shown so little understanding that they were dropped from the sample. At the time of the study, 1922, history was taught in the lowest grades of the elementary schools in England. Oakden and Sturt did not recommend postponing the teaching of history. Instead, they suggested that attention be given to helping children understand the time relationships required to understand history. They recommended using time charts, pictures, models, dramatizations, and handicrafts so that the past could be made as clear as possible to children.

Pistor (1940) compared an experimental and control group in their

understanding of historical time in an attempt to assess the effectiveness of providing instruction in history to children in grades four through six. Two matched groups of sixth grade students were given a "Battery of Time Concept Tests" which Pistor had developed. The questions on the tests pertained to chronology, sequence, historical analogies, and historical absurdities. The difference between the experimental group and control groups was that the latter had been taught traditional separate courses in geography and history in grades four and five while the experimental group had been taught courses in social studies, in which geography was the chief subject and history was introduced only incidentally. When the children were tested at the beginning of sixth grade, the scores for both groups were equivalent. Pistor concluded that previous training had no effect upon the development of the time concepts of the children studied. These findings have been cited extensively in literature pertaining to child development, social studies, and the elementary school curriculum (Jersild, 1946; Jersild, 1947; Wesley and Adams, 1952; Harris, 1960). Regardless of this, a question must be raised concerning the validity of the tests which were used in Pistor's study. The only mention of validity was the statement that "the time-concept tests were shown to be valid and reliable instruments for measuring children's time concepts" (p. 111). Yet, in another publication, Pistor (1939) revealed that the test battery had been validated for students of college age and not for sixth and seventh grade students.

The purpose of a study by Arnsdorf (1961) was to obtain evidence on the effect of organized instructional attempts to increase children's ability to understand time concepts pertaining to history. In this

study, which used a format similar to that in Pistor's study, one group of sixth grade students received instruction designed to increase their understandings of time concepts in history, and a "control" group of sixth graders did not receive instruction. Arnsdorf concluded that sixth grade students can profit from systematic instruction designed to increase their understanding of, and their ability to use, the time relationships common in the social studies. The author noted that his conclusion differed from Pistor's for the latter had maintained that increased understanding could only be achieved through maturation.

The following questions were posed in a study by McAulay (1963):

1. Do second grade children understand the relationship of the past to the present?

2. Are these children capable of understanding periods of time; can they pinpoint events in time which serve as marking places about which experiences might cluster or focus?

3. Are these children capable of projecting themselves from the immediate present into past time?

4. Do these children have an understanding of past social reality?

5. Do these children have an understanding of the continuity of time (p. 312)?

One hundred sixty-five second grade children were asked thirteen questions related to the various aspects of time, although the questions did not seem to be related to the questions McAulay said he was trying to answer. For example, four questions dealt with the child's age and the age of his brother or sister, his mother, and his grandmother. Five questions concerned comparisons, e.g., "Which is longer, a week or a month?" "Which will be here first, Christmas or Easter?" and "Who is older, your father or President Eisenhower?" Four questions were

associated with historical events, e.g., "Who lived first, Washington or Lincoln?" "Who lived here first, the white people or the Indians?" The major conclusion of this study was that social studies curricula for the second grade underestimate the child's understandings of time. However, in light of the ambiguities in his study, one cannot give too much credence to McAulay's conclusions.

In an attempt to obtain information concerning children's explanations of selected historical periods, Gorman (1968) presented his subjects with a box containing 19 toy figures and objects representing various historical periods. The children were asked to set the figures up in any way they wished. Four of the 14 children set the figures up into a time sequence, five children set them up into two fighting groups, and five set them up without arranging them in any pattern. Next, the children who had not placed the figures into a time sequence were asked to do so. Gorman stated that a wide range of understanding was shown by the 14 children in the study, with the four who had placed the figures into a time sequence immediately doing the best in all phases of the study. The children who were the most successful in the activity said they had learned about the figures and events from television and books. They could not remember having learned about them in school. Gorman pointed out that even with nine- and ten-year-olds the use of manipulative objects proved to be a more effective technique than interview questions alone or paper and pencil tests in gaining insights into children's understanding of historical time. The major conclusion of this study was that most of the nine- and ten-year-olds in the study showed sufficient readiness and interest to profit from instruction in the study of history.

A few studies (Spodek, 1962; Wann, Dorn, and Liddle, 1962) have indicated that children of preschool age are interested in, and may be able to deal with events remote in time. No systematic study of preschool children's historical concepts has been done. Certainly, further research is needed concerning the ability of young children to understand concepts of historical time.

Time and the Life Cycle

Previous studies of children's concepts of time have provided little information concerning children's understandings of any aspects of Time and the Life Cycle. Information has been limited primarily to the identification of the stage of development at which children can correctly tell their own age and their date of birth, and the stage at which they acquire the understanding that age is based on the time of birth rather than on size.

Personal or Subjectively Experienced Age

Previous research has established that three- and four-year-old children can tell their ages correctly (Ames, 1946; MacLatchy, 1951; Schector, Symonds, and Bernstein, 1955). MacLatchy (1951) found that few three-year-olds knew the month in which their birthday fell. Half of the four-year-olds knew it, as did all of the fives. Schecter, Symonds, and Bernstein (1955) found that all of their four to six-year-olds knew their age in terms of years. Many of the threes knew their birthday month, and the fours knew the date as well as the month. The fives and sixes knew the exact date of their birth and expressed their age in fractions. Age depending upon the time of birth was a concept

first found in the fives and sixes. For the threes and fours, age, to a large extent, was identified with size. The three-year-olds compared heights when one child had a birthday and revealed their belief that age was determined by size and vice versa. The fours, in playing with toy people, made such remarks as "the fireman is older because he is bigger and stronger." "The oldest is the fattest." The fives began to compare their ages by comparing their birth dates and determining who was older by who was born first. Furthermore, a younger but bigger child was able to explain, "I am bigger because I grew faster." This was a more advanced concept, demonstrating the relation of size upon rate of growth and the differentiation of the concept of age from that of size.

Gorman (1968) questioned nine- and ten-year-old children about the growth changes occurring in their own bodies. They described bodily changes as occurring in spurts. Most of the children said that their hair and nails remained the same length for several weeks, and then suddenly grew longer. They did not think of bodily changes and growth as a continuous process. They thought that they grew the most and changed the most on their birthday or during the few days prior to their birthday. On their birthday, they felt that recognizable changes had taken place in their bodies.

Piaget (1946) concluded that, for the young child, age meant growth and was not dependent upon order of birth. Adults remained the same age because they had ceased to grow. But, according to Piaget, as the child developed, he came to realize that age was dependent upon date of birth, although he believed that difference in age could still be modified with time, so that a younger, smaller child would reach the same age as an older one, when the former achieved the same height as the latter. It

was not until seven or eight years of age, in Piaget's view, that children understood that birth order was the decisive factor governing age.

Ages of Plants and Animals

Lovell and Slater (1960) used adaptations of Piaget's original tasks to study children's concepts of age. They showed 50 primary children a picture of a walnut tree and an elm tree. The walnut tree was short and spreading, and the elm tree was tall and sparse. From an examination of the pictures, it was impossible to know which was the older tree. The children were asked: (1) "Are these trees the same age?" (2) "Why do you think this one is older?" and (3) "Why do you think this one is younger?" The second task involved pictures of an apple tree in various stages of growth and pictures of a pear tree in various stages of growth. Subjects were asked to place the pictures on the table to show how the tree grew. Then they were told:

> One year after I planted the apple tree I planted a pear tree. Here is a picture of the pear tree I planted one year after the apple tree. Set out these pictures to show me how it grew. Look at all the trees and tell me which one is the oldest tree this year. How do you know that tree is the oldest? (pp. 179-180)

Five-year-olds thought the elm tree was older because it was taller or bigger. With increasing age, the number who continued to think in that way rapidly declined, but an increasing number thought the walnut tree might be older because it had more branches, or because it looked older. More children, even at eight and nine years of age, maintained that the age of a tree depended on when it was planted in the apple/pear experiment than in the walnut/elm experiment. In the former the child's attention was drawn to planting, while in the latter it was not. This

confirmed the common-sense point of view that the context of the question will affect the answer, especially in young children.

Schecter, Symonds, and Bernstein (1955) found that in the non-personal realm of plants and animals, none of the fours and only a minority of the fives could see age strictly as a function of time of birth or of planting. They saw it still in terms of size. The sixes showed greater differentiation of the concepts of age and size and less confusion in this area than the fives. The results of this study were in disagreement with Piaget's contention that these two concepts--(1) of age being dependent on time of birth and (2) of the conservation of age differences--are not established until the age of seven.

In Gorman's study (1968), children thought of time as an ingredient which plants needed in order to grow. If any of the four ingredients were not present, the plant would not be able to live. The children spoke of plants not having sufficient time in the same manner as they discussed plants not having sufficient air, soil, or water. Another distinction the children made was between clock time and "nature time" or "growth time." The personal time of living things was referred to as nature time or growth time. Clock time always passed at the same rate, but "nature time" sometimes passed slowly and sometimes passed quickly. For plants and trees, "nature time" passed slowly in the summer and winter, but passed quickly in spring and fall.

Ages of People

Little research information is available on children's concepts of the aging process in human beings. Bradley (1948) asked children to put into the correct sequence pictures of a baby, a boy, a youth, and so on.

Out of 18 five-year-olds, none succeeded, and only four out of 26 six-year-olds were able to do so. Unfortunately, Bradley did not describe the pictures, so there is not enough information about the nature of the task to draw any conclusions about young children's abilities to complete this kind of task.

Bromberg (1939) conducted a study of children's conceptualizations of aspects of the aging process. The author provided no information concerning the procedure he used or the number of children who were included. The only information Bromberg gave about the children was that they covered a wide range of intelligence levels. Bromberg found that children were able to describe accurately the physiological signs of old age, but he did not indicate the age at which the children were able to provide this description.

In their study of children from three to six years of age, Schecter, Symonds, and Bernstein (1955) found children's ideas of "old" to be broad, ranging from nine through 17, 27, 60, and 300 years of age. However, most of the four-, five- and six-year-olds could discern the relative youth from a series of pictures of people even though they had little idea of the actual ages of the people pictured. The fives and sixes described the aging process as: (1) when you get old you stop growing, (2) you get sick, (3) you shrink, and (4) you get gray hair. The sixes knew the approximate age of their parents, and most figured the life span of a person to be a hundred years or less.

In Gorman's study (1968), the effect of time on children was always described in positive terms, but its effect on older people was described in negative terms. Time was thought of as an abrasive force which slowly eroded the body. It put wrinkles in the skin, turned hair

gray, weakened the bones and organs of the body, and made old people shrink. One child said that time was like smoke which wore out both the inside and the outside of the body.

Implications for Present Study

From earlier research, it was clear that there were many gaps in existing knowledge pertaining to children's understanding of time and change. Most of the studies were done in the area of General Divisions of Time in the 1940's and 1950's. These studies concentrated on the child's acquisition of vocabulary rather than on the acquisition of concepts. Research studies in cognitive development have found that the acquisition of vocabulary is not the same as the acquisition of the related concept, for children are able to use appropriate words even though they have not grasped the concept which the words convey. This was borne out repeatedly in the study of Gorman (1968).

Studies of children's historical time concepts have led investigators to place the ability to deal with these concepts well beyond the preschool years. Again, however, the studies were done twenty or more years ago, and the methods used were not always appropriate for very young children. In addition, one cannot help wondering about the effect which television, mass communications and rapid transportation may have had upon children since these studies were completed. Few research studies were found concerning historical time concepts of children below the fourth grade. On the basis of studies of Spodek (1962) and Wann, Dorn, and Liddle (1962), it can be concluded that further research on young children's understanding of historical time is needed.

At best, only sketchy information is available about children's

concepts of time and the life cycle of plants, animals, and persons. The information available was usually collected incidentally as part of a larger study on some other aspect of time. The only study which attempted to study children's concepts in depth was Gorman's (1968). Unfortunately, the data on which his study was based were collected from in-depth interviews with only 14 children nine or ten years old. No study was found which focused on preschool children's concepts of time and the life cycle.

CHAPTER III

METHODS AND PROCEDURES

The overall purpose of this study was to determine young children's concepts of time and change as related to: (1) General Divisions of Time, (2) Historical Time, and (3) Time and the Life Cycle. To achieve this purpose, an instrument which minimized verbal responses and maximized opportunity for non-verbal responses was needed. Since no appropriate instrument was available, the first step in this study was the development of an instrument, the Time Understanding Test (TUT).

Development of the Instrument

The first step in the development of the Time Understanding Test, hereafter referred to as TUT, was the identification of items which would be related to the three areas of time and change to be included in this study: (1) General Divisions of Time, (2) Historical Time, and (3) Time and the Life Cycle. A task-oriented multi-sensory instrument was desired in order to maximize the child's opportunity to communicate his concepts to the investigator. Since an instrument which covered all three selected areas would be lengthy, it was crucial for the tasks to be interesting enough to capture and hold the child's attention. Over 100 possible items related to time and change were identified from the investigator's past ten years' experience with children and from interviews with early childhood education specialists. The first draft of

the TUT contained a total of 54 scored items, 18 in each of three subtests and eight open-ended questions. Sixty colored photographs were taken, from which 39 photographs would be chosen to illustrate the tasks on the TUT.

Establishment of Validity for the Instrument

Three procedures were used to establish validity for the TUT. First, the original tasks, along with the colored photographs, were submitted to a panel of judges for evaluation. Second, the revised draft was used with 16 preschool children to determine its appropriateness for use with young children. After the data for the study were obtained, an item analysis for each item on the TUT was computed to identify which items were answered correctly by the largest number of children in the sample, as well as those items which were missed by the largest number of children. Another purpose of the item analysis was to identify which items in the TUT distinguished between the responses of high- and low-scoring children.

Panel of Judges

The first draft of the TUT, containing 54 scored items and their accompanying selection of photographs, was submitted to a panel of seven judges for evaluation. All of the judges were experienced professionals in the field of early childhood education and held at least a master's degree in early childhood education or child development. The judges were provided with definitions of each of the categories to be studied, i.e., General Divisions of Time, Historical Time, and Time and the Life Cycle. An item was retained if six of seven judges rated it as meeting

the following criteria: (1) Were the directions clear and unambiguous? (2) Would the item or task be interesting to three-, four-, and five-year-old children? (3) Was the task placed in the appropriate sub-test, i.e., General Divisions of Time, Historical Time, or Time and the Life Cycle? Judges were asked to mark the best photographs to illustrate each task. The photographs evaluated by at least five of the seven judges to be most appropriate were included in the final form of the TUT. A copy of the instructions for the judges and the response sheet is found in Appendix A. All 54 original items were retained with minor rewording of some items on the basis of the judges' evaluations.

Pilot Study

The revised TUT was used in a pilot study with a group of 16 pre-school children. The group was composed of five three-year-olds, five four-year-olds, and six five-year-olds, with approximately equal numbers of boys and girls. Subjects in the pilot study were selected on the basis that some degree of rapport was already established between the investigator and the child. This was done in order to eliminate the effect that responding to a strange adult might have had on the results. The elimination of this effect made the primary focus the appropriateness of the instrument for use with three-, four-, and five-year-old children. Subjects were interviewed in their homes. Based on the subjects' responses, items were then re-evaluated by the investigator according to the following criteria: (1) Did the child understand the directions for the tasks on the TUT? (2) Did the tasks elicit appropriate responses from the children? (3) Were the tasks interesting to the children? (4) Was the TUT brief enough to hold the attention of the

children and minimize the effects of fatigue? Mean scores for the children in the pilot study are shown in Table I.

TABLE I

MEAN SCORES OF CORRECT RESPONSES FOR CHILDREN IN TUT PILOT STUDY

Subjects	Number in Group	Mean Score*
Three-year-olds	5	21.0
Four-year-olds	5	31.3
Five-year-olds	6	41.4

*Possible correct responses = 54

All of the subjects in the pilot study completed the TUT, were enthusiastic about it, and wanted to repeat it. On the basis of the children's responses, all of the original items were retained in the TUT. After administering the TUT in the pilot study, the investigator concluded that all four of the aforementioned criteria were met, that the TUT was an appropriate instrument to use with young children, and that it would discriminate between the time and change concepts of the different age groups. The final form of the TUT, including the photographs, is presented in Appendix B.

Selection of Subjects

A total of 90 subjects were chosen by random selection from approximately 400 children who were enrolled in 11 school groups in Stillwater, Oklahoma. Five groups were Child Development Laboratories operated by the Department of Family Relations and Child Development at Oklahoma State University, two groups were federally or locally sponsored compensatory education programs, three groups were privately owned day care centers, and one group was a non-profit program operated by a local church.

The following criteria were used in assigning children to age groups:

(1) Children from 36 through 47 months of age were classified as three-year-olds;

(2) Children from 48 through 59 months of age were classified as four-year-olds; and

(3) Children from 60 through 71 months of age were classified as five-year-olds.

Thirty children were selected from each age group, with equal numbers of boys and girls, by the following process of random selection. All possible subjects' names for each category e.g., three-year-old girls, five-year-old boys were placed in containers, and a person other than the investigator drew the names for each respective age and sex category.

Administration of the TUT

After the subjects were selected, letters were sent to the parents,

explaining the purpose of the research and asking permission for their child to participate. A copy of the letter can be found in Appendix C. In order to establish rapport with the subjects, the investigator visited each school group over a period of several days prior to the time the subjects were to be interviewed.

For the purpose of administration of the TUT to young children, the colored photographs corresponding to each task were standardized for size, mounted on 4 x 4 inch white cardboard, and laminated with plastic. This process made the photographs more uniform in appearance, more attractive, more durable, and more easily handled by young children.

All of the testing was done by the investigator. The testing was begun on December 1, 1973, and completed on March 8, 1974. In ten of the groups, each child was tested individually in a room provided by his school. In the church-related group, each child was interviewed in a corner of the classroom set apart from the remainder of the classroom as a "housekeeping center." All subjects were taken from their regular groups during school time for the purpose of a "special activity" with the investigator. In each case, the investigator minimized distractions in the testing room and spent a few moments establishing rapport with the child before the testing period began. No child was pressured to participate or to complete the test if he chose not to do so. Only one three-year-old male subject from the initial sample failed to respond, and he was replaced by another three-year-old male subject through the process of random selection described previously. No rewards were given the subjects for their participation, and none seemed to be needed.

The TUT is divided into three sub-tests, General Divisions of Time, Historical Time, and Time and the Life Cycle. Within each sub-test are

a number of sub-sections containing related items. To facilitate the administration of the TUT, the photographs related to each sub-section were placed inside a plain 8½ x 11 inch manila envelope. The entire TUT consisted of a stack of 15 envelopes. The envelopes containing the materials for each sub-section were shuffled before administration to each subject. Each subject was instructed to choose any envelope to begin and to choose any envelope he wished thereafter until he completed the entire stack of 15. This technique was used to minimize the effects of practice and to reorder the tasks randomly for each subject. This technique also helped the children to attend to the task, since they were absorbed in choosing envelopes, removing photographs, and replacing photographs. The technique of involving the subject in the selection of the items delighted the children in that it added the element of surprise to each new task.

As the subject removed the photographs from the envelope, explanations for the task were given by the investigator. After each task had been fully explained to the child, he was given as long as he needed to complete the task, so long as he was actively involved in solving it. A check of approximately one third of the testing sessions resulted in a mean time of 20 minutes for administration of the TUT, using the technique described above. There was no difference in the time required according to age or sex of the subjects.

Scoring of the TUT

The final form of the TUT contained 54 scored items and eight open-ended questions related to Time and the Life Cycle which were not scored. Each subject's responses to scored tasks were recorded by the

investigator on a data sheet developed for the TUT. The data sheet can be found in Appendix D. The TUT was scored numerically in order to yield data at the ordinal level of measurement. Each sub-test consisted of 18 scored items or tasks. Each item was scored in the left margin, +1 for a correct response or 0 for an incorrect response. Thus, each item within each sub-test was of equal value and each sub-test was of equal value in determining the total TUT score. For scored items, the child's actual response to the item was also recorded on the right-hand side of the data sheet. Several open-ended questions were included in order to add variety and to clarify the subjects' responses to scored items on the TUT. The possible range of scores for the TUT was 0 to +54.

Establishment of Reliability for the TUT

In order to establish a measure of reliability for the TUT, 60 subjects were chosen at random from the original group and were re-tested on the TUT from one to two weeks after their initial test. The random selection was accomplished by drawing ten names from the original sample for each age and sex category. The re-test sample included: (1) ten three-year-old boys and ten three-year old girls, (2) ten four-year-old boys and ten four-year-old girls, and (3) ten five-year-old boys and ten five-year-old girls.

Spearman rank correlation coefficients were calculated from the initial test scores and re-test scores for each sub-test and for the total TUT score. All of the re-tests were administered by the investigator during the period from December 1, 1973, to March 9, 1974. Spearman rank correlation coefficients for total TUT scores for the initial

tests and re-tests are presented, according to age, in Table II.

TABLE II

SPEARMAN RANK CORRELATION COEFFICIENTS FOR INITIAL TEST SCORES AND RE-TEST SCORES ON TOTAL TUT ACCORDING TO AGE

Age	Mean TUT Score Initial Test	Mean TUT Score Re-Test	Correlation Coefficient
Three-year-olds (N=20)	19.3	21.1	.516*
Four-year-olds (N=20)	25.5	27.9	.719***
Five-year-olds (N=20)	34.2	35.4	.758***

***($p<.001$)

*($p<.05$)

Rank-order correlation coefficients of .72 and .76 for three- and four-year-olds were beyond the .001 level of probability for four-year-olds and five-year-olds, indicating a fairly high level of reliability of responses for these ages. The r of .52, significant at the .019 level of probability for three-year-olds is less satisfactory, but quite expected since tests with three-year-olds very often reflect instability of responses.

Table III presents rank-order correlation coefficients for the initial tests and re-test scores on the sub-tests of the TUT, according

to age. Scores on the sub-test, General Divisions of Time, were reliable for four-year-olds ($p<.05$) and five-year-olds ($p<.01$). Scores on the sub-test Time and the Life Cycle were the most highly reliable on the TUT, significant beyond the .01 level for all three ages. The reliability of scores for each sub-test increased as the subjects' age increased, except for the sub-test Historical Time for five-year-olds.

TABLE III

SPEARMAN RANK CORRELATION COEFFICIENTS BY SUB-TESTS FOR INITIAL TEST SCORES AND RE-TEST SCORES ON THE TUT ACCORDING TO AGE

Sub-Test	Three-Year-Olds (N=20)	Four-Year-Olds (N=20)	Five-Year-Olds (N=20)
GENERAL DIVISIONS OF TIME	.351	.455**	.537***
HISTORICAL TIME	.199	.656***	.394*
TIME AND THE LIFE CYCLE	.637***	.587***	.839***

***($p<.01$)

**($p<.05$)

*($p<.10$)

When reliability scores were examined in further detail, differences were found between the responses of boys and girls. Data presented in Table IV show the discrepancy in reliability of scores on the

TABLE IV

SPEARMAN RANK CORRELATION COEFFICIENTS FOR INITIAL TEST SCORES AND RE-TEST SCORES ON THE TUT ACCORDING TO AGE AND SEX

Test	Three-Year-Olds		Four-Year-Olds		Five-Year-Olds	
	Boys N=10	Girls N=10	Boys N=10	Girls N=10	Boys N=10	Girls N=10
General Divisions of Time Sub-Test	.794***	.068	.360	.604*	.556*	.727***
Historical Time Sub-Test	.216	.175	.682**	.840***	.120	.594*
Time and the Life-Cycle Sub-Test	.541*	.758***	.526*	.637**	.763***	.796***
Total TUT Score	.578*	.723***	.532*	.942***	.684**	.724***

***($p<.01$)

**($p<.05$)

*($p<.10$)

sub-test Historical Time. The responses to the sub-test Historical Time, though reliable ($p<.01$) for four-year-olds, were less reliable for five-year-olds, and the coefficient obtained for five-year-old males indicated even less reliability of responses than for three-year-olds of both sexes. Table IV indicates that the responses for the sub-test Time and the Life Cycle were more reliable for three-year-old females ($p<.01$) and four-year-old females ($p<.05$) than for three-year-old males ($p<.10$) and four-year-old males ($p<.10$), and were highly reliable ($p<.01$) for five-year-olds of both sexes. The level of reliability for the total TUT reflects significant differences according to sex, as reported in Table IV. Reliability of scores on the TUT were significant beyond the .01 level for three-, four-, and five-year-old females, but reached only the .05 level for five-year-old males and the .10 level for three-, and four-year-old males.

On the basis of the reliability coefficients reported in this chapter, the investigator accepted the TUT as a reliable instrument for use with three-, four-, and five-year-old children. It was a more reliable instrument for females than for males.

Collection and Analysis of Data

Collection of Data

During each testing session, the investigator recorded all responses on the data sheet developed for the TUT. Each subject was assigned a two-digit code number for personal identification, a two-digit code number for identification of his school, and a three-digit code number for identification of the date of testing.

IBM data preparation sheets were prepared prior to keypunching the data on IBM data cards. The following information was recorded for each subject: (1) subject's identification number; (2) school identification number; (3) data identification number; (4) age; (5) sex; and (6) score for each item on the TUT. The same procedure was followed for the 60 subjects who were re-tested in the reliability study, with an additional code identifying the scores as re-test scores. A chain print-out was prepared and key-punched information was verified by the investigator and by a computer programmer at the Oklahoma State University Computer Center.

Selection of Statistical Procedures

In his text on principles of behavioral research, Kerlinger (1964) concluded: "In brief, in most cases in education and psychology, it is probably safer--and usually more effective--to use parametric tests rather than nonparametric ones" (p. 259). Anderson (1961), in a definitive article on the subject of parametric versus nonparametric procedures said: "It was concluded that parametric procedures are the standard tools of psychological statistics, although nonparametric procedures are useful minor techniques" (p. 315). After conferring with Dr. Larry Claypool of the Oklahoma State University Statistics Department, it was determined that the unique characteristics of the data in this study met the two major assumptions for the use of parametric tests, the assumption of normality and the assumption of interval level of measurement. The key factor in this decision was the possible number of scale points in each sub-test and in the total TUT score. It was determined that an ordinal scale with at least 12-15 scale points has a

distribution which may adequately approximate the normal distribution and may be treated as interval level data. The combined factors of the size of the randomly selected sample (90), the possible scale points for each sub-test (18), and the TUT total score (54) for each subject justified the use of parametric procedures. Because the number of scale points was greater than that necessary to represent interval level data, the measurement requirement was met. Therefore, parametric procedures were the most appropriate procedures to use for statistical analyses of major hypotheses.

Statistical Procedures

An item analysis, using Chi-square, was computed to identify which items on the TUT distinguished between the responses of high- and low-scoring children. Parametric procedures used to test major hypotheses were the analysis of variance and the Pearson product-moment correlation. The advantage of the analysis of variance was that it not only established whether there was a significant difference between two means, but also established what the magnitude of the difference had to be in order to be significant at any given level of probability. Another advantage was that it was possible to determine whether there was a significant interaction between age and sex. Descriptive statistics, means, frequencies, and percentages of correct responses, were analyzed in relation to the over-all purpose of the study--to determine what children actually know about time and change. All statistical analyses were made using the Statistical Analysis System Programs (SAS) and the Oklahoma State University IBM 360 Computer.

CHAPTER IV

ANALYSIS AND RESULTS

Determination of Discriminating Items on the TUT

Chi-square analysis was used to determine which items discriminated between subjects whose scores fell in the lower quartile from those whose scores fell in the upper quartile of total TUT scores. Results of the item analysis are presented in Table V. Forty-six of the original 54 items were discriminating at the .05 level of significance or beyond. The eight non-discriminating items were deleted in subsequent statistical analyses. Non-discriminating items were Questions 4, 8, 13, 22, 32, 37, 41, and 49. Generally, these items were non-discriminating because they were missed by most of the subjects or were answered correctly by most of the subjects, regardless of total TUT performance. Question 4, "What day of the week is today?" was missed by 96 percent of the three-year-olds, 86 percent of the four-year-olds, and 80 percent of the five-year-olds. The following items were non-discriminating because they were answered correctly by over 90 percent of the children in each age group: (1) Question 37--"How old are you?" (2) Question 41--"Were you ever a baby?" and (3) Question 49--"Here are some pictures of men. Show me the boy, or the youngest one." Question 22--"Show me the picture of how women dressed a long time ago, the longest time ago of all"--was

TABLE V

CHI-SQUARE ANALYSIS REFLECTING DISCRIMINATING ITEMS ON THE TUT

Item	X^2 Value[1]	Level of Probability
General Divisions of Time		
Day-Night		
1. Show me the picture of day.	5.88	.014
2. Show me the picture of night.	5.88	.014
3. Right now, is it day or night?	8.69	.003
Yesterday, Today, Tomorrow, and Days of the Week		
4. What day of the week is today?	2.22	.131
5. What day of the week is it at your house?	5.15	.022
6. Was yesterday a school day?	15.72	.001
7. What day of the week was yesterday?	6.62	.009
8. Is tomorrow a school day?	3.73	.050
9. What day of the week is tomorrow?	7.78	.005
10. What day of the week is not a school day?	20.22	.001
Season, Month, and Year		
11. Show me the picture of winter.	4.49	.032
12. Show me the picture of summer.	7.14	.007
13. Which one is a picture of spring?	2.70	.096
14. Show me the picture of fall.	6.41	.011
15. Right now, is it fall, winter, spring or summer?	10.19	.001
16. Which season will come next, after this one?	12.29	.001
17. What month is it?	6.62	.009

TABLE V (Continued)

Item	X^2 Value[1]	Level of Probability
18. What year is it?	6.62	.009
Historical Time		
Animals in History		
19. Show me the animal that lived a long, long time ago.	11.76	.001
20. Which animal lives now?	8.66	.003
21. Do these animals (point to dinosaur) live today?	35.95	.001
Clothing in History		
22. Show me the picture of how women dressed a long time ago, the longest time ago of all.	2.65	.099
23. Which one shows how women dress now?	17.10	.001
24. Put all three in a row to show the one that lived the longest time ago, then next, until now.	27.75	.001
Transportation in History		
25. Here are some ways to travel. Show me the oldest or "olden times" way.	9.33	.002
26. Show me the newest way.	7.20	.007
27. Put all three pictures in a row to show me the oldest way, then next, then the newest way.	33.87	.001
Automobiles in History		
28. Show me the oldest car.	17.10	.001
29. Show me the newest car.	9.33	.002
30. Put all three cars in a row to show the oldest, then next, then the newest.	30.68	.001

TABLE V (Continued)

Item	X^2 Value[1]	Level of Probability
Airplanes in History		
31. Show me the picture of the oldest airplane.	10.28	.001
32. Show me the picture of the newest airplane.	2.70	.096
33. Put all three airplanes in a row to show the oldest, then next, then the newest airplane.	19.36	.001
Houses in History		
34. Which is the oldest house?	11.02	.001
35. Which is the newest house?	17.78	.001
36. Put all three houses in a row to show the oldest house, then next, then the newest house.	21.40	.001
Time and the Life Cycle		
Personal or Subjectively Experienced Age		
37. How old are you?	2.18	.134
38. When is your birthday?	14.03	.001
39. Will you be older or younger on your birthday?	13.94	.001
40. How old will you be on your birthday?	21.24	.001
41. Were you ever a baby?	3.36	.063
42. (If S answers "yes" to above) Were you a baby boy or a baby girl?	8.66	.003
Ages of Animals		
43. Show me the youngest baby chick.	4.98	.024
44. Show me the oldest chicken.	5.74	.015
45. Put all three pictures in a row to show how the chicken grew up.	34.43	.001

TABLE V (Continued)

Item	X^2 Value[1]	Level of Probability
Ages of Plants		
46. Show me the youngest tree, or baby tree.	7.20	.007
47. Show me the oldest tree.	11.02	.001
48. Put all three pictures in a row to show how the tree grew up and then got old.	26.13	.001
Ages of People		
49. Here are some pictures of a man. Show me the boy, or the youngest one.	3.36	.063
50. Which one is the oldest?	10.17	.001
51. Put all three pictures in a row to show how the boy grew up and then became an old man.	30.41	.001
52. Here are some pictures of a woman. Show me the girl, or the very youngest one.	5.88	.014
53. Which one is the oldest one?	13.44	.001
54. Put all three pictures in a row to show how the girl grew up and then became an old woman.	27.25	.001

[1]Degrees of freedom = 1

answered correctly by 70 percent of the three-year-olds, 76 percent of the fours, and eighty-six percent of the fives. Questions 8, 13, and 32 were non-discriminating because they yielded inconsistent results related to total TUT performance.

Examination of Major Hypotheses

Hypothesis 1: There is no significant difference in young children's concepts of General Divisions of Time as measured by scores on the TUT, according to: (a) age, (b) sex, and (c) age and sex. This hypothesis was tested statistically for significant differences between the mean scores by the analysis of variance.

Mean scores on the sub-test General Divisions of Time for subjects of different ages and sexes are presented in Table VI. For three-year-olds the mean score was 5.7, for four-year-olds the mean was 6.5, and for five-year-olds the mean was 8.7. Results of the analysis of variance are presented in Table VII. There was a significant difference ($p<.001$) according to age. At the .01 level of probability, the differences between mean scores, or least significant difference (LSD) had to be greater than 1.54. Five-year-olds scored significantly higher ($p<.01$) than four-year-olds and three-year-olds, but four-year-olds did not score significantly higher than three-year-olds at the .05 level of probability. This highly significant difference related to age was the result of the magnitude of the difference between the four-year-olds and five-year-olds.

Both males and females had a mean score of 6.9 for the sub-test General Divisions of Time. No significant difference existed at the .05 level of probability between males and females, as indicated in

TABLE VI

MEAN SCORES FOR SUB-TEST GENERAL DIVISIONS OF TIME REFLECTING DIFFERENCES BY AGE AND SEX
N=90

Age Group	Mean Scores[1]		
	Females (N=15)	Males (N=15)	Total
Three-year-olds	4.9	6.5	5.7
Four-year-olds	6.9	6.1	6.5
Five-year-olds	9.0	8.3	8.7
Total	6.9	6.9	6.9

[1]Possible score = 15

TABLE VII

ANALYSIS OF VARIANCE REFLECTING DIFFERENCES IN CONCEPTS OF GENERAL DIVISIONS OF TIME ACCORDING TO AGE AND SEX
N=90

Source of Variation	df	Mean Square	F Value	Prob.>F	LSD.01[1]	LSD.05[2]
Age	2	68.977	13.428	0.001	1.5	1.2
Sex	1	0.011	0.002	0.962	1.3	1.0
Age and Sex	2	13.644	2.656	0.074	2.2	1.7
Residual	84	5.136				
Corrected Total	89	6.704				

[1]Least significant difference at .01 level of probability

[2]Least significant difference at .05 level of probability

Table VII. The interaction between age and sex was not significant at the .05 level. It should be noted, however, that the interaction was significant at the .07 level of probability, with four-year-old females and five-year-old females scoring higher than males and three-year-old males scoring higher than females.

On the basis of data presented in Table VII, Hypothesis 1a could be rejected. There was a highly significant ($p<.001$) difference in children's concepts of General Divisions of Time according to age. Hypothesis 1b could not be rejected. There was no significant difference according to sex in children's concepts of General Divisions of Time. Hypothesis 1c could not be rejected at the .05 level of probability. At the .07 level of probability there was an interaction between age and sex, with four- and five-year-old females scoring higher than males of the same ages and three-year-old males scoring higher than three-year-old females in the sub-test General Divisions of Time.

Hypothesis 2. There is no significant difference in young children's concepts of Historical Time as measured by scores on the TUT, according to: (a) age, (b) sex, and (c) age and sex. The analysis of variance was used to test for significant differences between the mean scores.

Mean scores for the sub-test Historical Time according to age and sex are presented in Table VIII. Mean score for threes was 7.0, for fours, 9.5, and for fives, 13.2. Results of the analysis of variance computed to test for significant differences between these means are presented in Table IX. There was a significant difference ($p<.001$) in young children's concepts of Historical Time according to age. At the .01 level of probability the mean scores had to be greater than 1.8,

TABLE VIII

MEAN SCORES FOR SUB-TEST HISTORICAL TIME REFLECTING REFLECTING DIFFERENCES BY AGE AND SEX
N=90

Age Group	Mean Scores[1]		
	Females (N=15)	Males (N=15)	Total
Three-year-olds	6.5	7.4	7.0
Four-year-olds	10.1	8.9	9.5
Five-year-olds	12.7	13.7	13.2
Total	9.8	10.0	9.9

[1]Possible score = 16

TABLE IX

ANALYSIS OF VARIANCE REFLECTING DIFFERENCES IN CONCEPTS OF HISTORICAL TIME ACCORDING TO AGE AND SEX
N=90

Source of Variation	df	Mean Square	F Value	Prob.>F	LSD.01[1]	LSD.05[2]
Age	2	301.477	42.075	.001	1.8	1.4
Sex	1	1.344	0.187	.670	1.5	1.1
Age and Sex	2	11.744	1.639	.199	2.6	2.0
Residual	84					
Corrected Total	89					

[1]Least significant difference at .01 level of probability

[2]Least significant difference at .05 level of probability

The differences between mean scores of threes and fours was 2.5, and the difference between mean scores of fours and fives was 2.7. Therefore there was a significant difference ($p<.01$) between the scores of threes and fours and between the scores of fours and fives ($p<.01$).

The mean score of females was 9.8 and of males 10.0, a difference of only .2. The difference in the mean scores had to be greater than 1.1 in order to be significant at the .05 level of probability (Table IX). Therefore, there was no significant difference in concepts of Historical Time according to sex. However, a significant difference related to sex was found in one sub-section of Historical Time. An F value of 3.88 and an LSD above .36 was obtained for the sub-section called Ages of Automobiles, indicating a significant difference ($p<.05$) between males and females in their ability to identify how styles of automobiles have changed throughout history, with males scoring significantly higher ($p<.05$) than females.

Three-year-old and five-year-old males scored higher than females of the same ages and four-year-old females scored higher than males for Historical Time. Data presented in Table IX indicated that there was no significant interaction between age and sex in children's concepts of Historical Time.

On the basis of data presented in Table IX, Hypothesis 2a could be rejected. There was a highly significant difference in young children's concepts of Historical Time according to age. Hypothesis 2b could not be rejected. There was no significant difference in young children's concepts of Historical Time according to sex, except in their ability to identify ages of automobiles. Hypothesis 2c could not be rejected. There was no significant interaction between age and sex in children's

concepts of Historical Time.

Hypothesis 3. There is no significant difference in young children's concepts of Time and the Life Cycle as measured by scores on the TUT, according to: (a) age, (b) sex, and (c) age and sex. The test used to determine whether significant differences existed in the mean scores was the analysis of variance.

Mean scores for the sub-test Time and the Life Cycle for different ages and sexes are presented in Table X. Mean score for three-year-olds was 7.1, for four-year-olds, 9.3, and for five-year-olds, 12.2. Results of the analysis of variance presented in Table XI indicated a highly significant difference ($p<.001$) according to age. At the .01 level of probability, the difference in mean scores had to be greater than 1.7. The difference between the mean scores of three-year-olds and four-year-olds was 2.2, and the difference between four- and five-year-olds was 2.9. Therefore, there was a significant difference ($p<.01$) between the scores of three-year-olds and four-year-olds and a significant difference ($p<.01$) between the scores of four-year-olds and five-year-olds.

On the sub-test Time and the Life Cycle, the average score was 9.8 for females and 9.3 for males (Table X), a difference of only .5. As presented in Table XI, the difference between means, or the LSD, must be greater than 1.1 at the .05 level of probability. From data presented in Table XI, it was concluded that there was no significant difference in young children's concepts of Time and the Life Cycle according to sex. A significant difference according to sex was found, however, in one sub-section--Ages of People--which required subjects to identify photographs of females of different ages and place them in sequence from youngest to oldest. Females scored significantly ($p<.01$) higher on this

TABLE X

MEAN SCORES FOR SUB-TEST TIME AND THE LIFE CYCLE REFLECTING DIFFERENCES IN AGE AND SEX
N=90

Age Group	Mean Scores[1]		
	Females (N=15)	Males (N=15)	Total
Three-year-olds	7.0	7.2	7.1
Four-year-olds	9.7	8.9	9.3
Five-year-olds	12.7	11.7	12.2
Total	9.8	9.3	9.5

[1]Possible score = 15

TABLE XI

ANALYSIS OF VARIANCE REFLECTING DIFFERENCES IN CONCEPTS OF TIME AND THE LIFE CYCLE ACCORDING TO AGE AND SEX
N=90

Source of Variation	df	Mean Square	F Value	Prob.>F	LSD.01[1]	LSD.05[2]
Age	2	196.300	30.363	.001	1.7	1.3
Sex	1	6.944	1.074	.304	1.4	1.1
Age and Sex	2	2.744	.425	.661	2.4	1.8
Residual	84	6.465				
Corrected Total	89	10.653				

[1]Least significant difference at .01 level of probability

[2]Least significant difference at .05 level of probability

task than males. The task of identifying photographs of males of different ages and placing them in sequence from youngest to oldest had been identified by previous chi-square analysis as non-discriminating because it was performed correctly by over 90 percent of all subjects in the study. Apparently, both males and females could identify ages of men and place them in an age sequence.

Four- and five-year-old females had higher mean scores than males on the sub-test Time and the Life Cycle, but three-year-old males had slightly higher mean scores than females. From the data presented in Table XI, it was concluded that there was no significant interaction between age and sex for the sub-test Time and the Life Cycle.

On the basis of data presented in Table XI, Hypothesis 3a could be rejected. There was a significant difference ($p<.001$) in young children's concepts of Time and the Life Cycle according to age. Hypothesis 3b could not be rejected. There was no significant difference according to sex in young children's concepts of Time and the Life Cycle. There was a significant difference ($p<.01$) according to sex in young children's ability to identify ages of females, with females scoring significantly higher on this task than males. Hypothesis 3c could not be rejected. There was no significant interaction between age and sex in young children's concepts of Time and the Life Cycle.

Hypothesis 4. There is no significant difference in young children's concepts of time and change as reflected in their total TUT scores, according to (a) age, (b) sex, and (c) age and sex. This hypothesis was tested for significant differences between mean scores by the analysis of variance.

Mean scores for the total TUT are presented by age and sex in

Table XII. Mean scores for threes was 19.8, for fours, 25.3, and for fives, 34.1. Table XIII presents findings of the analysis of variance computed to test the significance of the differences among these mean scores. At the .01 level of probability the differences in the mean had to be greater than 4.0. The difference between the mean scores of threes and fours was 5.5, and the difference between the mean scores of fours and fives was 8.8, indicating a significant difference ($p<.01$) between scores of threes and fours and a significant difference ($p<.01$) between scores of fours and fives. From data presented in Table XIII, it was concluded that there was a significant difference ($p<.001$) in children's total TUT scores according to age.

For the total TUT, mean scores for females (26.5) and males (26.2) differed by .3. As shown in Table XIII, the difference in mean scores had to be greater than 2.4 at the .05 level of probability. Therefore, there was no significant difference in total TUT scores according to sex.

Reflecting the results of the sub-tests, four- and five-year-old females had higher mean total scores than males of the same ages and three-year-old males had higher mean scores than three-year-old females. In the three-year-old group, males scored higher than females throughout the study. Four- and five-year-old females scored higher than males for the sub-tests General Divisions of Time (Table VI) and Time and the Life Cycle (Table X). Five-year-old males scored higher than females on the sub-test for Historical Time (Table VIII). Reflecting this inconsistency, the interaction between age and sex for the TUT total score was not significant at the .05 level of probability.

Results indicated that Hypothesis 4a could be rejected. There was

TABLE XII

MEANS OF TOTAL SCORES ON THE TUT REFLECTING DIFFERENCES BY AGE AND SEX
N=90

Age Group	Mean Scores[1]		
	Females (N=15)	Males (N=15)	Total
Three-year-olds	18.5	21.1	19.8
Four-year-olds	26.7	23.9	25.3
Five-year-olds	34.5	33.7	34.1
Total	26.5	26.2	26.4

[1]Possible score = 15

TABLE XIII

ANALYSIS OF VARIANCE REFLECTING DIFFERENCES IN TUT TOTAL SCORES ACCORDING TO AGE AND SEX
N=90

Source of Variation	df	Mean Square	F Value	Prob>F	LSD.01[1]	LSD.05[2]
Age	2	1567.511	45.942	.001	4.0	3.0
Sex	1	2.500	0.073	.784	3.2	2.4
Age and Sex	2	56.933	1.668	.193	5.6	4.2
Residual	84	34.119				
Corrected Total	89	68.735				

[1]Least significant difference at .01 level of probability

[2]Least significant difference at .05 level of probability

a significant difference based on age in children's concepts of time and change as reflected by their total TUT scores. Hypothesis 4b could not be rejected; there was no significant interaction between age and sex in children's concepts of time and change as reflected by their total TUT scores.

Hypothesis 5. There are no significant relationships between General Divisions of Time, Historical Time, and Time and the Life Cycle as conceptualized by young children. Hypothesis 5 was tested for significance by computation of Pearson r correlation coefficients between each sub-test and between the sub-tests and the total TUT score. Results of this analysis are presented in a four-by-four matrix in Table XIV. Individual cells were structured to place the correlation value at the top of each cell and the level of probability at the bottom.

TABLE XIV

CORRELATION COEFFICIENTS BETWEEN SUB-TESTS GENERAL DIVISIONS OF TIME, HISTORICAL TIME, AND TIME AND THE LIFE CYCLE, AND TUT TOTAL SCORES

	General Divisions of Time	Historical Time	Time and the Life Cycle	TUT Total
General Divisions of Time	1.000[1] .000	.594 .001	.542 .001	.792 .001
Historical Time		1.000 .000	.700 .001	.909 .001
Time and the Life Cycle			1.000 .000	.877 .001

[1]Probability of correlation coefficient being due to chance

Historical Time was the most highly correlated with the TUT total score; Time and the Life Cycle was next; and General Divisions of Time was least correlated with the TUT total score. Therefore, the subjects' scores on the sub-test Historical Time were the best measure of their total TUT score. Historical Time and Time and the Life Cycle were more closely related to each other than either was related to General Divisions of Time.

Correlation coefficients between all sub-tests and between sub-tests and total TUT score were highly significant ($p<.001$). Therefore, Hypothesis 5 could be rejected. There were significant relationships between General Divisions of Time, Historical Time, and Time and the Life Cycle as conceptualized by young children.

Subjects' Knowledge of Discriminating Items on the TUT

The major purpose of the study was to determine young children's concepts of time and change. Descriptive statistics related to the major purpose are presented in this section.

General Divisions of Time

Percentage of correct responses for the sub-test General Divisions of Time are presented in Table XV. Tasks related to Day-Night were easy for children of all three age groups. Over 80 percent of all subjects could identify photographs of day and night and could tell whether it was day or night at the time of testing.

All questions under Yesterday, Today, and Tomorrow, and Days of the Week were difficult. The easiest items were the questions asking

TABLE XV

FREQUENCIES AND PERCENTAGES OF CORRECT RESPONSES FOR SUB-TEST GENERAL DIVISIONS OF TIME
N=90

Item	Three-Year-Olds (N=30) f	%	Four-Year-Olds (N=30) f	%	Five-Year-Olds (N=30) f	%
Day-Night						
1. Show me the picture of day.	25	83	30	100	29	97
2. Show me the picture of night.	26	87	29	97	29	97
3. Right now, is it day or night?	24	80	26	87	25	83
Yesterday, Today, Tomorrow, and Days of the Week						
4. What day of the week is today?	1	3	4	13	6	20
5. What day of the week is it at your house?	2	7	3	10	9	30
6. Was yesterday a school day?	14	47	19	63	25	83
7. What day of the week was yesterday?	0	0	2	7	6	20
8. Is tomorrow a school day?	14	47	19	63	21	70
9. What day of the week is tomorrow?	3	10	4	13	11	37
10. What day of the week is not a school day?	8	27	9	30	18	60
Season, Month, and Year						
11. Show me the picture of winter.	23	77	24	80	26	87
12. Show me the picture of summer.	21	70	16	53	21	70
13. Which one is a picture of spring?	10	33	17	57	15	50
14. Show me the picture of fall.	12	40	16	53	18	60

TABLE XV (Continued)

Item	Three-Year-Olds (N=30) f	%	Four-Year-Olds (N=30) f	%	Five-Year-Olds (N=30) f	%
15. Right now, is it fall, winter, spring, or summer?	10	33	9	30	16	53
16. Which season will come next, after this one?	2	7	7	23	12	40
17. What month is it?	1	3	1	3	7	23
18. What year is it?	0	0	0	0	7	23

whether yesterday was a school day and whether tomorrow was a school day. Forty-seven percent of threes and 63 percent of fours answered both questions correctly. Eighty-three percent of fives could tell whether yesterday was a school day, and 70 percent could tell whether tomorrow was a school day. The most difficult questions were those requiring subjects to name a day of the week. No three-year-olds could name the day of the week for yesterday, only seven percent of fours could, and 30 percent of fives. The name of the day of the week for tomorrow was easier, with ten percent of threes, thirteen percent of fours, and thirty-seven percent of fives responding correctly.

The percentage of correct responses for Question 5--"What day of the week is it at your house?" requires further explanation, Question 4 required the children to name which day of the week they thought it was, and the purpose of Question 5 was to find out whether children believe that it was the same day of the week in other places as it was at school. The subject's response to the question was marked correct if he gave the same response as he gave in Question 4, whether it was correct or incorrect. Only 7 percent of threes, 10 percent of fours, and 30 percent of fives believed that it was the same day at home and at school.

In response to the question, "What day of the week is not a school day?" 27 percent of threes and 30 percent of fours responded correctly, and twice that many (60 percent) fives responded correctly. The most frequent correct response was "Sunday," with two three-year-olds, seven four-year-olds, and 15 five-year-olds responding either "Sunday" or "Saturday and Sunday." Other frequent responses for fours and fives were "cartoon day," and "Christmas." Three-year-olds responded to this

question in terms of activities or descriptions of what they did on days they were not in school. Typical three-year-old responses included, "when I play at my house," "play day," "when I go to Grandmother's house," "when I go to church," "church day," and "cartoon day." Threes and fours also responded to this question with numbers, i.e., "29," "5," "11," and "6." No five-year-old responded in this manner.

In the sub-section Season, Month, and Year, the most difficult question was, "What year is it?" No threes or fours could name the year, and only seven fives could do so. Only one three-year-old and one four-year-old and seven five-year-olds could name the current month. Identification of photographs of seasons of the year was much easier for the children. The most frequently identified seasons were winter and summer. The range for identification of "winter" was from 77 percent of threes to 87 percent of fives. Seventy percent of threes and fives could identify summer and 53 percent of fours. More four-year-olds than five-year-olds identified spring correctly. All of the testing was done in the winter, and 33 percent of threes, 30 percent of fours, and 53 percent of fives gave the correct response, "winter," to Question 15--"Right now, is it fall, winter, spring or summer?" The correct response for Question 16--"Which season will come next, after this one?" was dependent on the response to Question 15. For a correct response, the child must answer with the name of the season which followed the response he gave in Question 15. For example, the correct response, "spring," was only correct for those subjects whose previous response was "winter." Only seven percent of the three-year-olds and 23 percent of the four-year-olds answered correctly, compared with 40 percent of the five-year-olds.

Mean scores by age and sex for the TUT sub-tests and total scores are presented in Table XVI. Mean scores for the sub-test General Divisions of Time ranged from 4.9 for three-year-old females to 9.0 for five-year-old females, indicating that the highest mean score was only 60 percent of the possible total score of 15. General Divisions of Time was the most difficult sub-test for all groups, regardless of age or sex.

TABLE XVI

MEAN SCORES BY AGE AND SEX FOR TUT SUB-TESTS AND TUT TOTAL SCORES
N=90

Variable	Age					
	Three (N=30)		Four (N=30)		Five (N=30)	
	Males (N=15)	Females (N=15)	Males (N=15)	Females (N=15)	Males (N=15)	Females (N=15)
General Divisions of Time (possible score = 15)	6.5	4.9	6.1	6.9	8.3	9.0
Historical Time (possible score = 16)	7.4	6.5	8.9	10.1	13.7	12.7
Time and the Life Cycle (possible score = 15)	7.2	7.1	8.9	9.7	11.7	12.7
TUT Total (possible score = 46)	21.1	18.5	23.9	26.7	33.7	34.5

Historical Time

Frequencies and percentages of correct responses for the sub-test Historical Time are presented in Table XVII. In Animals in History, from 70 percent of the threes to 90 percent of the fives could identify a dinosaur as the animal which "lived a long long time ago" and a cow as the animal which lives now. When the investigator pointed to the dinosaur and asked, "Do these animals live today?" only 47 percent of three-year-olds answered correctly, compared with 77 percent of fours and 80 percent of fives. If the subject answered the above question correctly, he was asked, "What happened to the dinosaurs?" The most frequent responses were, "They all died" (given by 23 children), and "They all got killed" (given by six children). If the subject indicated that he thought dinosaurs were still alive, he was aksed, "How do you know?" The most frequent response to this question was, "I saw one." When asked where they had seen one, subjects answered, "in a zoo," "in a book," and "on T.V."

In the sub-section Clothing in History so many subjects were able to identify the 1880's costume as "how women dressed a long time ago" that the item was found to be non-discriminating. When subjects were asked to place the three photographs in a historical sequence, only 10 percent of three-year-olds could accomplish this, compared with 30 percent of fours and 57 percent of fives. In the other sub-sections of Historical Time, from approximately half of the three-year-olds to 90 percent or more of the five-year-olds could identify the "oldest" in a series of photographs of modes of travel, automobiles, airplanes, and houses. Results of the historical sequencing task were consistent,

TABLE XVII

FREQUENCIES AND PERCENTAGES OF CORRECT RESPONSES FOR TUT SUB-TEST HISTORICAL TIME, BY AGE
N=90

Item	Three-Year-Olds (N=30) f	%	Four-Year-Olds (N=30) f	%	Five-Year-Olds (N=30) f	%
Animals in History						
19. Show me the animal that lived a long, long time ago.	21	70	25	83	27	90
20. Which animal lives now?	22	73	28	93	27	90
21. Do these animals (point to dinosaur) live today?	14	47	23	77	24	80
Clothing in History						
22. Show me thepicture of how women dressed a long time ago, the longest time ago of all.	21	70	23	77	26	87
23. Which one shows how women dress now?	15	50	22	73	28	93
24. Put all three in a row to show the one that lived the longest time ago, then next, until now.	3	10	9	30	17	57
Transportation in History						
25. Here are some ways to travel. Show me the oldest or "olden times" way.	15	50	22	73	28	93
26. Show me the newest way.	20	67	25	83	29	97
27. Put all three pictures in a row to show the oldest way, then next, then the newest way.	1	3	10	33	23	77

TABLE XVII (Continued)

Item	Three-Year-Olds (N=30) f	%	Four-Year-Olds (N=30) f	%	Five-Year-Olds (N=30) f	%
Automobiles in History						
28. Show me the oldest car.	13	43	22	73	26	87
29. Show me the newest car.	15	50	15	50	24	80
30. Put all three cars in a row to show the oldest, then next, then the newest.	5	17	5	17	23	77
Airplanes in History						
31. Show me the picture of the oldest airplane.	19	63	24	80	27	90
32. Show me the picture of the newest airplane.	13	43	18	60	21	70
33. Put all three airplanes in a row to show the oldest, then next, then the newest.	4	13	7	23	18	60
Houses in History						
34. Which is the oldest house?	19	63	22	73	28	93
35. Which is the newest house?	14	47	19	63	28	93
36. Put all three houses in a row to show the oldest house, then next, then the newest house.	8	27	6	20	20	67

as shown in Table XVI. Only a small percentage of threes were able to accomplish the sequencing task and less than 33 percent of the fours, compared with from 60 to 77 percent of the fives.

As indicated in Table XV, mean scores for Historical Time were higher than mean scores for General Divisions of Time, ranging from 6.5 for three-year-old females to 13.7 for five-year-old males, of a possible score of 16. Results indicated that young children were not only interested in history, but also had significant knowledge of changes that have occurred throughout history, as measured by the TUT. From 60 percent to 77 percent of the five-year-olds in this study were able to place three photographs of methods of travel and styles of automobiles, airplanes, and houses in a correct historical sequence.

Time and the Life Cycle

Frequency and percentage of correct responses for the sub-test Time and the Life Cycle are presented in Table XVIII. The section on Personal or Subjectively Experienced Age had the highest percentages of correct response for any sub-section on the TUT. So many children knew their age that the question was non-discriminating. All of the threes knew their age, compared with 90 percent of fours and 93 percent of fives. An analysis of the data sheets indicated that those four- and five-year-olds who missed the question had recently had a birthday. Subjects were given credit for a correct response to the question, "When is your birthday?" if they responded with the correct month only or the correct month and day of the month. There was little difference in the responses of threes and fours, with more threes than fours answering correctly. Over twice as many fives knew their birthdays. Only five

TABLE XVIII

FREQUENCIES AND PERCENTAGES OF CORRECT RESPONSES FOR TUT SUB-TEST TIME AND THE LIFE CYCLE, BY AGE
N=90

Item	Three-Year-Olds (N=30) f	%	Four-Year-Olds (N=30) f	%	Five-Year-Olds (N=30) f	%
Personal or Subjectively Experienced Age						
37. How old are you?	30	100	27	90	28	93
38. When is your birthday?	11	37	9	30	21	70
39. Will you be older or younger on your birthday?	8	27	12	40	24	80
40. How old will you be on your birthday?	16	53	22	73	27	90
41. Were you ever a baby?	27	90	25	83	29	97
42. (If S answers "Yes" to above) Were you a baby boy or a baby girl?	23	77	26	87	29	97
Ages of Animals						
43. Show me the youngest baby chick.	12	40	19	63	19	63
44. Show me the oldest chicken.	19	63	16	53	22	73
45. Put all three pictures in a row to show how the tree grew up and then got old.	4	13	12	40	19	63
Ages of Plants						
46. Show me the youngest tree, or the baby tree.	21	70	27	90	27	90
47. Show me the oldest tree.	17	57	23	77	26	87
48. Put all three pictures in a row to show how the tree grew up and then got old.	2	7	11	37	19	63

TABLE XVIII (Continued)

	Item	Three-Year-Olds (N=30) f	%	Four-Year-Olds (N=30) f	%	Five-Year-Olds (N=30) f	%
49.	Here are some pictures of a man. Show me the boy, or the youngest one.	28	93	28	93	29	97
50.	Which one is the oldest?	23	77	27	90	30	100
51.	Put all three pictures in a row to show how the boy grew up and then became an old man.	10	33	13	43	24	80
52.	Here are some pictures of a woman. Show me the girl, or the very youngest one.	25	83	27	90	28	93
53.	Which one is the oldest child.	19	63	24	80	30	100
54.	Put all three pictures in a row to show how the girl grew up and then became an old woman.	4	13	12	40	22	73

three-year-olds and five four-year-olds knew both the month and day of their birthdays, compared with 15 of the five-year-olds. Only eight threes knew whether they would be older or younger on their birthdays, compared with 12 fours and 24 fives. When questioned further, many three-year-olds responded that they would be "bigger" but not "older" on their next birthday. So many of the subjects understood that they were once a baby that the question was non-discriminating. Most of the subjects understood that their sex had remained constant since birth, with the range from 77 percent of threes to 97 percent of fours. Four three-year-olds indicated that babies did not have a sex, but were just "babies." It was more difficult for subjects of all ages to identify the age of animals (chickens) than the age of plants. Forty percent of threes and 63 percent of fives could identify the youngest chick as the one cracking out of the egg (Appendix B) compared with 70 percent of threes and 90 percent of fives who could identify the youngest tree.

In the section on Ages of People, it was easier for subjects of all ages to identify the youngest male than the youngest female. The same was true for three-year-olds and four-year-olds in identifying the oldest person. All of the five-year-olds could identify the oldest male and the oldest female. It was discussed previously that there was a significant difference according to sex in children's ability to identify ages of females, with females scoring significantly higher than males. The results of the sequencing tasks were consistent with those in the section on Historical Time. Few three-year-olds could place three photographs in a sequence, while the majority of five-year-olds could complete the task successfully. Frequent responses of three-year-olds and some four-year-olds to the request to place three photographs

in a sequence was to stack them or to place two photographs in a sequence, the youngest and the oldest, omitting the intermediate stage.

Results of Responses to Open-Ended Questions Related to Children's Concepts of the Aging Process

In order to clarify further children's concepts of the aging process in humans, subjects were shown several photographs of very old persons (Appendix B) and were asked to respond to the following questions:

1. Do you know somebody who is old?
2. How can you tell he/she is old?
3. What makes people old?
4. Is your mother old? Your father?
5. Would you like to be old? Why (or why not?)
6. Do you think you will ever get old?

During the pilot study, the investigator became aware that this section of questions made some of the children uneasy. Five of the 16 subjects in the pilot study responded, "I don't like these old people," or "I don't like these questions." For this reason, the questions and photographs were not included in the random ordering of tasks for administration of the TUT to each subject during the subsequent experimental study. The above questions and photographs were presented to the subjects in the experimental study at the end of the testing period in order to give the investigator maximum opportunity to build rapport with the subject before asking the questions. A fatigue factor may have been operating in some subject's responses. During the experimental study some subjects again stated, "I don't like these old people." None of

the subjects refused to answer the questions during the initial test; however, during the re-testing for reliability, several subjects responded, "Oh, no, I hope you aren't going to ask me about those old people again." During the re-test several subjects refused to answer this set of questions. An example of a typical comment of a child who refused to answer this set of questions was, "I don't want to talk about these. I don't like old people" (Three-year-old male). Since responses to these questions related to the aging process were for clarification purposes only, the responses were not subjected to statistical analysis. A discussion of the responses can be found in Chapter V.

CHAPTER V

DISCUSSION OF FINDINGS

Findings Related to General Divisions of Time

General Divisions of Time was the most difficult of the TUT subtests, for it was found that almost none of the children could name the day of the week, even though such instruction was common in their preschool, day-care, or kindergarten group. In some cases, even when children were taken from the classroom immediately after completing the daily routine of marking the calendar and discussing the day of the month and date, the investigator found that the child could not identify the month or day of the week. This finding may have implications for those responsible for development and design of preschool and kindergarten curricula.

The results of this study were generally in agreement with the results of earlier studies with respect to the order of the development of concepts related to General Divisions of Time, but children in this study did not do as well as children of the same age reported in earlier research. As in earlier studies, children were able to deal with the future (tomorrow) better than the past (yesterday). However, tasks related to "yesterday" and "tomorrow" were extremely difficult for the subjects in this sample. Spayde (1953) reported that 59 percent of a sample of kindergarten age children could identify the day of the week

for "today." Results of this study indicated that only 20 percent of the five-year-olds responded correctly. Consistent with the findings of earlier studies, Sunday was the first day of the week to be identified, but only 50 percent of the five-year-olds in this study did so, compared with 94 percent reported by Spayde (1953).

The results of this study supported the conclusions of the earlier studies by Ames (1946), Spayde (1953), and Schecter, Symonds, and Bernstein (1955) with regard to identification of winter and summer, but not spring and fall. In all studies, subjects identified winter first, then summer. In the earlier studies, children identified spring before fall; whereas, in this study, children identified fall before spring.

Ames (1946) reported that 30-33 percent of five-year-olds could name the month and 30 percent could name the year. Results of this study indicate that only one three-year-old, one four-year-old, and seven five-year-olds knew the month. No three and four-year-olds knew the year, and only 23 percent of the five-year-olds knew the year. The results of this study support the findings of earlier studies that children first characterize time in terms of activities. Three-year-olds characterized days of the week as "play day," "church day," "cartoon day," and "when I go to Grandma's house." Three- and four-year-olds also identified days of the week, seasons, and months with numbers. No such responses were reported in earlier research. A plausible explanation might be the influence of the mass media and the current emphasis on cognitive development in children's television programming. Results of this study also support Sturt's (1925) observation, made 50 years ago, that children identify seasons not as a mark of time, but as a "description of concrete material things that enter directly into

their experience" (p. 51). In this study, all of the testing was done in the winter, and on warm sunny days, three- and four-year-olds identified the season as spring or summer, "because the sun is shining, and it's hot."

Previously, it was discussed that the highly significant difference in children's concepts of General Divisions of Time according to age was the result of the magnitude of the difference between the responses of the four-year-olds and five-year-olds. There was no significant difference in responses of three-year-olds and four-year-olds. General Divisions of Time was the most difficult of the sub-tests and was the least correlated with the other sub-tests and the total TUT score

Based on the results of this study, it is suggested that concepts of General Divisions of Time require an advanced stage of intellectual development where children can operate on a hypothetical proposition rather than being restricted to what they have experienced. As Freud (1950) and Piaget (1954) suggested, knowledge of days of the week, months, seasons, and years requires the child to be able to become objective in relation to the outside world and society's way of dealing with time. Results of this study indicated that instruction in General Divisions of Time would not be profitable for three- and four-year-old children. Instruction in the area of General Divisions of Time would be more appropriate for five-year-olds in kindergarten. Ironically, daily instruction related to identifying days of the week, months, and seasons of the year is common practice in many preschools and nursery schools. Instruction related to the other areas, Historical Time and Time and the Life Cycle is rarely included in the preschool curriculum.

Findings Related to Historical Time

Findings of this study did not support those of previous research (Oakden and Sturt, 1922; Pistor, 1940) which placed the development of historical time concepts well beyond the preschool years. The majority of children (70-90%), regardless of age, identified dinosaurs as animals which "Lived a long time ago" and most of the four-year-olds (77%) and five-year-olds (80%) knew that dinosaurs are now extinct. When asked, "What happened to the dinosaurs?" several four- and five-year-olds responded in a manner which indicated they had the beginning of an understanding of how the arrival of man and ecological changes over time had affected the dinosaurs. Some of these responses were:

"They vanished, and it got really hot then." (Five-year-old male)

"The earth got really cold and they all got dead." (Five-year-old male)

"They turned into gas--they are all killed." (Five-year-old male)

"They all died, because, you see, the people shot them in the jungles." (Five-year-old male)

"They all died when people started to come. Men used to look like gorillas a long time ago." (Four-year-old female)

"They died, because you see there wasn't enough plants. The meat-eaters didn't have enough meat. The meat-eaters ate the plant-eaters, and, see, everybody had to eat a different thing. There wasn't enough plants for the plant-eaters, so they died; then the meat-eaters ate the plant-eaters and they died. See, they all ate each other." (Four-year-old male)

"They lived a long time ago when nobody was around to watch them. "That's how they died--they didn't have any food. They were meat-eaters." (Three-year-old female)

Many of the three-year-olds (43-63%) and the majority of four- and five-year-olds (73-93%) could identify the oldest or "olden times" mode of travel and changes in styles of automobiles, airplanes, and houses throughout history. So many children of all ages (70-87%) could identify a female costume of the 1880's that the item was judged non-discriminating.

The finding that the historical sequencing task was consistently very difficult for three- and four-year-olds, but relatively easy for five-year-olds, suggested the need for further research regarding the ability of preschool children to place items and events in a sequence. The question should also be asked whether the ability to place items or events in a time sequence is a reflection of children's time concepts or of their ability to perform mathematical sequencing tasks. Even though the three- and four-year-olds in this study could not place the photographs in an exact historical sequence, they could identify items from the past and compare them with those of the present. A conclusion which can be made is that young children are not only interested in history, but also have an impressive knowledge of changes that have occurred throughout history, as measured by the TUT. Results support the suggestions of Wann, Dorn, and Liddle (1962), Robison and Spodek (1965), Gorman (1968), and Todd and Heffernan (1970) that young children can develop concepts of another point in time and can begin to develop an understanding of the "structure" of history. Based on the results of this study, it seems feasible that teachers of young children might plan to integrate the study of history with the study of science and other social studies. Craig (1958) has suggested that these concepts are essential in the science education of young children: (1) The universe

is very large--Space; (2) The earth is very old--Time; (3) The universe is constantly changing--Change; (4) Life is adapted to the environment--Adaptation; (5) There are great variations in the universe--Variety; (6) The interaction of forces--Equilibrium and Balance. As teachers work toward these goals, children could be encouraged and helped to discover more about life in its early forms, about adaptation of humans and animals, and about the significance of historical changes which have taken place through time.

Findings Related to Time and the Life Cycle

Children in this study were more knowledgeable about the areas included in the sub-test Time and the Life Cycle than in the other areas studied, i.e., General Divisions of Time and Historical Time. As in earlier studies (Ames, 1946; MacLatchy, 1951; Schecter, Symonds, and Bernstein, 1955) almost all the children knew their age. Results of this study did not support the findings of MacLatchy (1951) that half of the four-year-olds in her study and almost all the fives knew their birthday month. In this study, few four-year-olds (19%) and only half of the five-year-olds knew the month of their birthday. One of the major differences in the results of this study compared with earlier studies was in relation to the children's concepts of ages of people. Bradley (1948) reported that no five-year-old from a sample of 18 could put pictures of people in correct age sequences, while 80 percent of the five-year-olds in this study could put photographs of males in a correct age sequence and 73 percent could arrange photographs of females in such a sequence. Since Bradley (1948) did not describe the photographs he used, it is not possible to compare the differences in the results of

the two studies. With respect to some four-year-olds and most five-year-olds, results of this study supported early research findings (Bromberg, 1939) that children are able to describe accurately the physiological signs of old age. Because of the lack of information and methodological problems inherent in some of the very early research, it is difficult to make comparisons with current research, but the significant sex differences found in the ability to discriminate ages of females merits further investigation. Additional research might establish whether this difference according to sex is due to the differing perceptions of female and male children, or whether it may have resulted from the particular photographs used in this study to accompany the tasks. As females get older, they do tend to look more like males. It is possible that the photographs of the oldest woman used in this study resembled a male and was disregarded as a possible choice by males; however, if this were so it would seem likely that females also would have perceived the older woman as a male. Results indicate that females definitely perceived this photograph as a female.

The failure of most three-year-olds and many four-year-olds to complete the sequencing task, consistent with the results found in the sub-test Historical Time, merits further study. Responses to the open-ended questions related to children's concepts of aging in humans further clarify children's concepts of Time and the Life Cycle.

Responses to Open-Ended Questions Related to the Aging Process

Responses to questions related to the aging process are discussed here because they revealed insights into children's concepts of the

aging process and suggested several possibilities for further research in this area. In response to, "Do you know somebody who is old?" only one three-year-old, four four-year-olds, and four five-year-olds responded, "no." When asked "who?" they knew who was old, however, 15 three-year-olds pointed to the photographs in front of them and replied, "They are," compared with ten four-year-olds and only three five-year-olds who responded in this manner. Children's responses indicated that three-year-olds may have had a different interpretation of the word "know" than four- and five-year-olds. The persons most often identified as "old" by the subjects were "grandfather" or "grandmother." Nine three-year-olds, 12 four-year-olds, and 20 five-year-olds responded in this manner. One four-year-old and three five-year-olds responded "great grandmother." The only other responses given were, "my aunt," "George Washington," and "Dirty Sally" (current television character).

In response to "How can you tell he is old?" the most frequent responses of three-year-olds concerning the old persons they knew were non-specific ones such as, "I just know it," "'Cause they look old," and "I saw they were old." More specific three-year-old responses were: (1) "'Cause they got old eyes and old hair," (2) "'Cause they're dirty," (3) "Because they are so old-fashioned," (4) "Because they work all the time and they get real broken down," and (5) "They have freckles and wrinkles."

Four-year-old responses tended to be non-specific, but more fours than threes attempted to describe how they could tell that the old people they knew were old. Examples of four-year-old responses were:

> "My grampa fought a battle and he was so sick. After the war, dirt was everywhere."

"He was working for a long long time--that's how he got old."

"I can see dirt in his head."

"Because she has spots on her face."

"'Cause she has bumpety things on her, and she walks with a cane and has a wheel chair."

"Because they got stuff on them, like hay."

"Because of their faces--they frown."

Five-year-olds gave more specific responses than threes and fours and their responses were more descriptive of the actual appearance of old people they knew, using nouns such as "lines" and "wrinkles" and a variety of adjectives to describe old people. Some typical five-year-old responses were:

"Their faces are all crumpled up and their eyes are old."

"She has lines on her face."

"They talk old--they sound kind of wiggly."

"Her face looks 'squiveled' up."

"Because they've got an old house, and old shoes and clothes and stuff."

"Because they have a lumpy forehead."

"He has 'crunchy' cheeks."

"Because he has big blue veins in his hands, and he has to hold on when he walks."

"Well, she walks funny and she has wrinkles on her face and she talks funny."

There was an identifiable difference in the responses of four- and five-year-olds to the question, "What makes people get old?" The most frequent response of three- and four-year-olds was, "I don't know."

Six three-year-olds indicated that "having birthdays" and "getting bigger" made people get old. Some three-year-old responses were: (1) "They get bigger," (2) "Growing makes you get old," (3) "'Cause they get bigger and bigger and then get old," (4) "Having birthdays." Six four-year-olds also indicated that living a long time made people get old. Some responses of four-year-olds were: (1) "How they grow makes them old," (2) "Living in houses a long time," and (3) "When you stay a long time you get old."

Natural elements in the environment were identified as causes of aging by three- and four-year-olds. These children attributed aging to such factors as dirt, sand, wind, and bugs. The idea that excesses of certain habits caused aging was also characteristic of three- and four-year-olds. Aging was seen to be caused by working too hard, smoking too much, drinking too much coffee, and eating too much. Two five-year-olds also listed smoking as a cause of aging.

Ten five-year-olds said that they didn't know what caused people to get old; the other 20 were able to verbalize their concepts in detail and appeared to have a definite understanding of the process of aging. Five-year-old responses included: (1) "They get older and older with their birthdays," (2) First, they're young and then they live more and get older after a while," (3) "They grow and live a long time," (4) "People live a long long time without a husband or a wife," and (6) "They get older and older until the new people come in."

When asked, "Is your mother old?" only four three-year-olds, three four-year-olds, and two five-year-olds replied "yes." Seven three-year-olds, five four-year-olds, and three five-year-olds thought their father was old. Children in this sample were more likely to see their

fathers as being old than their mothers, but the majority of subjects did not believe that either of their parents was old.

Nearly half of the three-year-olds saw being old as a positive thing, compared with almost none of the fours and fives. When asked if they would like to be old, 12 three-year-olds responded affirmatively, but only three four-year-olds and three five-year-olds did so. Children three years of age gave reasons such as, "I could grow a mustache," "I would get bigger," and "I could wash dishes." The four- and five-year-olds who said they would like to be old equated being old with having what might be regarded as a sense of power, such as "When I'm old I'll be a big man and my mother won't get mad at me," and "When I'm old I could have a Big Wheel and ride a Yamaha 250." Most of the four-year-olds and five-year-olds stated emphatically that they would not like to be old. Those who gave reasons for not wanting to be old equated being old with being sick or crippled and with dying. Some of the specific responses related to the relationship between age and sickness were: (1) "'Cause I would be sick and throw up," (2) "'Cause old makes people dangerous, then sick," (3) "Because if you're old, you're crippled and have to walk with a square walker," (4) "'Cause you can't run or nothing if you're old and crippled." Four- and five-year-olds had different ways of expressing their fear of dying. Some responses were: (1) "Because I could die," (2) "Because I would get killed," (3) "I don't want to die," and (4) "Because if you're old you die."

The final question was, "Do you think you will ever get old?" Only 11 three-year-olds and 12 four-year-olds responded "yes," compared with 22 five-year-olds. Several four- and five-year-olds answered this question reluctantly by saying, "I will, but I don't want to."

No final conclusions could be drawn from the open-ended questions related to children's concepts of the aging process, but preliminary ideas emerged which provided suggestions for further research in this area. From the limited information available, it appeared that there was a difference in the thinking and attitudes of three-year-olds and five-year-olds concerning the process of aging. The data were consistent with Piaget's theory (1969) that to a child aging is not a perpetual and continuous process, but rather a process of change tending towards certain states; time ceases to flow once these states are attained. According to Piaget, young children equate aging with growing up; when growing stops, time ceases to operate. Children who exhibit this level of thinking equate size with age. This explains why a three-year-old believes that he can "catch up" in age and marry some favorite adult when he grows up. It also may help explain why some children said their father was old when they did not believe their mother was old. Piaget applies his theory to children below seven years of age. Limited data from this study indicated that many four- and five-year-olds had moved beyond this level of thinking to a concept of the succession and duration of life. Three-year-olds in this study were more positive in their attitude toward aging than five-year-olds. Five-year-olds, who could describe the physical changes that take place in the aging process--who understood that aging is the inevitable outcome of "having birthdays and living a long time," and who understood that they would someday be old--were the most negative in their attitudes toward aging. Several five-year-olds remarked spontaneously, "I don't like olds," or "I don't like old people." The question is whether this negative attitude is the result of a change in the intellectual abilities and concepts of

children between their third year and their fifth year, the result of societal attitudes toward the aged, or the result of a combination of both factors. More research needs to be done in the area of young children's concepts and attitudes toward aging. It can be concluded from the findings of this study that there was a definite, observable difference in the way in which five-year-olds think about the aging process compared with the point of view of three-year-olds. As children become older, their understanding of the life cycle of humans increases and their attitudes toward the idea of growing "old" becomes more negative,

CHAPTER VI

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

Purpose of the Study

The major purpose of this study was to ascertain young children's concepts of time and change in order to expand current knowledge in this area and to increase effectiveness in planning curriculum for young children. The specific areas studied were children's concepts in relation to General Divisions of Time, Historical Time, and Time and the Life Cycle. Since no appropriate instrument was available to achieve the purposes of the study, a task-oriented multi-sensory instrument, the Time Understanding Test (TUT), was developed by the investigator in the first phase of the study. The TUT contained three sub-tests, General Divisions of Time, Historical Time, and Time and the Life Cycle.

Specific purposes of the study were to: (1) determine the relationship between preschool children's chronological age and their concepts in each of the selected areas, i.e., General Divisions of Time, Historical Time, and Time and the Life Cycle; (2) determine the relationship between preschool children's sex and their concepts in each of the selected areas, i.e., General Divisions of Time, Historical Time, and Time and the Life Cycle; and (3) determine the relationships between children's understanding of one aspect of time and change and other

aspects of time and change.

Methods of the Study

The subjects were 90 children three, four, and five years of age who were randomly selected from a total of 400 children enrolled in 11 school programs in Stillwater, Oklahoma. Thirty children were randomly selected for each age group, with even numbers of boys and girls in each age group. The TUT was administered to each subject by the investigator. Sixty children were randomly selected to be re-tested for the purpose of establishing a measure of reliability for the TUT. In the re-test sample, there were 20 children in each age group, with equal numbers of boys and girls. All testing was done during the period from December 1, 1973, to March 8, 1974.

Spearman rank correlation coefficients were computed between initial test scores and re-test scores to establish a measure of reliability for the TUT. Chi-square analysis was used in an item analysis to determine which items on the TUT significantly differentiated between the subjects scoring in the upper and lower quartiles of total TUT scores. The analysis of variance was used to determine whether there were significant differences according to age or sex, and whether there were significant interactions between age and sex for: (1) General Divisions of Time, (2) Historical Time, Time and the Life Cycle, and (3) total TUT scores. Descriptive statistics, means, frequencies, and percentages were analyzed in order to determine what children actually know about the three areas studied.

Results and Conclusions

Major results of the study were:

1. The TUT was established as a reliable instrument for testing three-, four-, and five-year-old children's concepts of time and change in the three areas of General Divisions of Time, Historical Time, and Time and the Life Cycle.
2. The technique used in administering the TUT was highly effective with three-, four-, and five-year-old children.
3. Forty-six of the 54 items on the TUT were significantly discriminating between upper and lower quartile groups at the .05 level of probability or beyond.
4. There was a significant difference ($p<.001$) according to age in three-, four-, and five-year-old children's concepts of General Divisions of Time, Historical Time, and Time and the Life Cycle.
5. There was no significant difference according to sex in three-, four-, and five-year-old children's concepts of General Divisions of Time, Historical Time, and Time and the Life Cycle, except in the ability to identify ages of automobiles ($p<.05$) and ages of women ($p<.01$).
6. There were significant relationships among all three areas studied, General Divisions of Time, Historical Time, and Time and the Life Cycle as conceptualized by young children. There was a closer relationship between children's concepts of Historical Time and Time and the Life Cycle than between either of these areas and General Divisions of Time.

On the basis of results, it was concluded that instruction in concepts of General Divisions of Time would not be appropriate or profitable for three- and four-year-old children. Such instruction would be appropriate for five-year-old children.

Three-, four-, and five-year-old children were interested in history and in concepts related to an understanding of Time and the Life Cycle, and they had an impressive amount of knowledge in these areas. A logical conclusion was that three-, four-, and five-year-old children could benefit from curricula designed to help them understand concepts of history and concepts of the succession of life and the life cycle of animals, plants, and persons.

The general conclusion can be made that instruction in the area of time and change would be appropriate for both preschool age boys and girls, since, with few exceptions, there were no significant differences according to sex in children's concepts of General Divisions of Time, Historical Time, and Time and the Life Cycle, as measured by the TUT. Results of the study indicated that as children got older and understood more about the life cycle and succession of life, they became more negative about the idea of growing "old" and more negative in their attitudes toward elderly people.

In light of that, it was concluded that groups of young children could profit from experiences with aged persons, those who have lived history and can help young children come to know about and understand their historical heritage. Margaret Mead (1972) has discussed the isolation of young children from other generations and from other segments of society, as well as the resulting discontinuity in the lives of young children. As a partial solution to these problems,

Dr. Mead advocated combining early childhood centers with centers for elderly people. She has suggested that even though elderly people are not strong enough to do all the work of handling young children, they can sit and listen to them, tell them stories, teach them historical crafts, and--most importantly--provide continuity in their lives. Increased contact with aged persons may help to change children's negative attitudes toward old persons and toward the process of growing old in our society.

Methodological Limitations of the Research

The methodological limitations of the study include: (1) the size of the sample, which restricted the degree to which results can be generalized; (2) the random sample which was limited to a convenience population, children enrolled in preschool and day care programs in Stillwater, Oklahoma; and (3) variable controls which were limited, i.e., there were no controls of the influence of teacher style, method of instruction, school curriculum, or home environment, all of which could affect children's concepts of General Divisions of Time, Historical Time, and Time and the Life Cycle.

Recommendations

Results of this study indicated the need for further research in the following areas:

1. Experimental programs in early childhood education need to be developed which include learning experiences related to Historical Time and Time and the Life Cycle.

2. Teachers who are interested in further investigation of the advisability of teaching concepts of General Divisions of Time could use an experimental-control group research design to study the effectiveness of teaching concepts related to General Divisions of Time to three- and four-year-old children.
3. Some apparent sex differences merit further investigation. The responses of females were more reliable than the responses of males. Four- and five-year-old females scored higher than males on every part of the TUT, while three-year-old males scored higher than three-year-old females in every sub-test. Further research in the area of differences in children's concepts of time and change according to sex seems warranted.
4. Some of the significant differences identified in this study, i.e., the inability of males to identify ages of women, may have been the result of the photographs used to illustrate the items. Development of a different set of illustrative photographs for each task and repetition of this experiment is recommended. Comparison of the results with results of this study would yield more information about the effect of the photographs on the responses of subjects.
5. Results indicating that the historical sequencing task was consistently difficult for three- and four-year-olds but relatively easy for five-year-olds suggests the need for further research on children's abilities to place items and events in a historical sequence.
6. Results of this study indicate that one of the most fruitful areas for further research is children's concepts of the

aging process in humans, and children's attitudes toward aged persons. Additional research needs to be conducted in this area in order to substantiate or negate the indications of this study that, between the ages of three and five, children become more negative toward elderly persons and toward the idea of growing old.

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APPENDIX A

July 20, 1973

To: Panel of Judges
From: Judy Powell
Re: Evaluation of the TUT, Time Understanding Test, to be used as an instrument in my doctoral research

I need your help in evaluating the instrument I have developed for my doctoral research involving children's concepts of time. The overall purpose of my study is to determine three-, four-, and five-year-olds' understanding of time as related to: (1) General Divisions of Time, (2) Historical Time, and (3) Time and the Life Cycle.

The following definitions will help you in this task:

General Divisions of Time

For the purposes of this study, the term "General Divisions of Time" includes children's understandings of "day and night," "yesterday, today, and tomorrow," "days of the week," "month," "year," and "seasons of the year."

Historical Time

This category includes the child's ability to understand that which has happened in the past, both as to subjective time when it is related to the child's own personal life, and objective time when it is related to external societal time.

Time and the Life Cycle

As developed for this study, this category includes children's understandings of the life cycles of humans, animals, and plants. It also includes children's ideas about their own existence in time and their own growth processes, as well as changes that take place in living and non-living things in the world around them.

INSTRUCTIONS FOR EVALUATION

Please consider each test item (on front of each envelope) and the corresponding pictures according to the following criteria:

1. Are the directions clear and unambiguous?

2. Will the item or task be interesting to young children?

3. Is the item or task related to the time concepts, as defined above?

4. Is the item or task placed in the appropriate sub-test, i.e., General Divisions of Time, Historical Time, or Time and the Life Cycle?

5. Are the pictures appropriate to the items or tasks? (These are preliminary pictures. They will all be the same size in the final form, and will be mounted on cardboard with a laminated finish.)

If you feel the items and corresponding pictures are satisfactory, place a check (√) in the blank beside the number of the item. If you wish to make suggestions about the item or the picture, or if you wish to ask a question, please do so in the blank beside the number of the item.

Thank you so much for helping me in the development of this instrument.

JUDGES' EVALUATION SHEET--TIME UNDERSTANDING TEST

Judge _____

Position _____

If you feel the items and corresponding pictures are satisfactory, place a check (✓) in the blank beside the number of the item. If you wish to make suggestions about the item or the picture, or if you wish to ask a question, please do so in the blank beside the number of the item.

GENERAL DIVISIONS OF TIME

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
13. _____
14. _____
15. _____
16. _____
17. _____
18. _____

HISTORICAL TIME

19. _____

20. _____

21. _____

22. _____

23. _____

24. _____

25. _____

26. _____

27. _____

28. _____

29. _____

30. _____

31. _____

32. _____

33. _____

34. _____

35. _____

36. _____

TIME AND THE LIFE CYCLE

37. _____

38. _____

39. _____

40. _____

41. _____

42. _____

43. _____

44. _____

45. _____

46. _____

47. _____

48. _____

49. _____

50. _____

51. _____

52. _____

53. _____

54. _____

PLEASE EVALUATE THE OPEN-ENDED DISCUSSION QUESTIONS HERE.

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

ADDITIONAL COMMENTS:

THANK YOU!

APPENDIX B

Illustration 1. Day-Night

Child selects photographs of the same outdoor scene, one showing day, the other showing night.

_____1. Show me the picture of day.

How can you tell it is day? _____

_____2. Show me the picture of night.

How do you know it is night? _____

_____3. Right now, is it day or night? _____

Illustration 2. Yesterday, Today, Tomorrow, and Days of the Week

The days of the week are Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, and Sunday.

_____ 4. What day of the week is today? _____

_____ 5. What day of the week is it at your house? _____

_____ 6. Was yesterday a school day? _____

_____ 7. What day of the week was yesterday? _____

_____ 8. Is tomorrow a school day? _____

_____ 9. What day of the week is tomorrow? _____

_____10. What day of the week is not a school day? _____

1975 JANUARY 1975

SUN.	MON.	TUE.	WED.	THU.	FRI.	SAT.
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

Illustration 3. Season, Month, and Year

Child chooses from four colored photographs, outdoor scenes depicting the four seasons.

_____11. Show me the picture of winter.

How do you know it is winter? _____

_____12. Show me the picture of summer.

How can you tell it is summer? _____

_____13. Which one is a picture of spring?

How can you tell it is spring? _____

_____14. Show me the picture of fall.

How can you tell it is fall? _____

_____15. Right now, it is fall, winter, spring, or summer? _____

_____16. Which season will come next, after this one? _____

_____17. What month is it? _____

_____18. What year is it? _____

_____TOTAL SCORE - General Divisions of Time

Illustration 4. Animals in History

Child chooses photographs of a dinosaur and a cow.

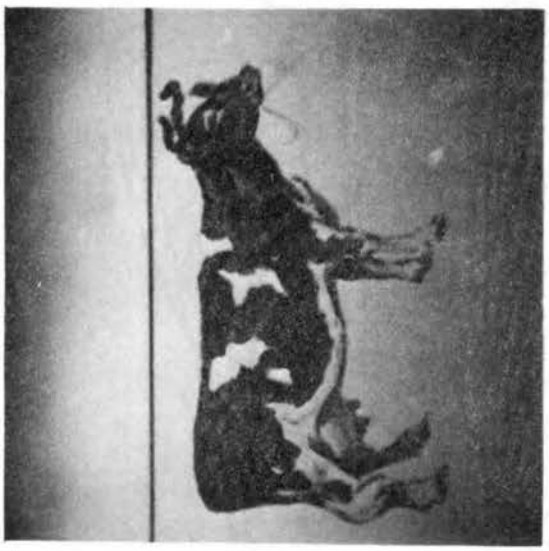
_____19. Show me the animal that lived a long, long time ago.

_____20. Which animal lives now?

_____21. Do these animals (point to dinosaur) live today? _____

(If response was "yes," ask, "How do you know?") _____

(If response was "no," ask, "What happened to the dinosaurs?") _____



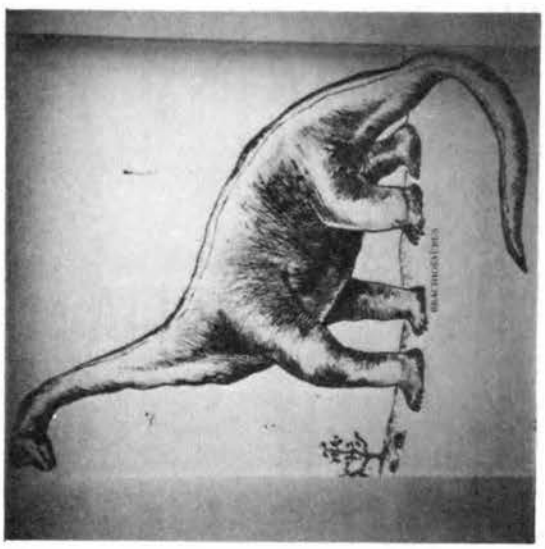


Illustration 5. Clothing in History

Child chooses three photographs of a female in different styles of clothing--a costume of the late 1800's, the 1940's, and a 1970's pant suit.

_____22. Show me the picture of how women dressed a long time ago, the longest time ago of all.

_____23. Which one shows how women dress now?

_____24. Put all three pictures in a row to show the one that lived the longest time ago, then next, then now.

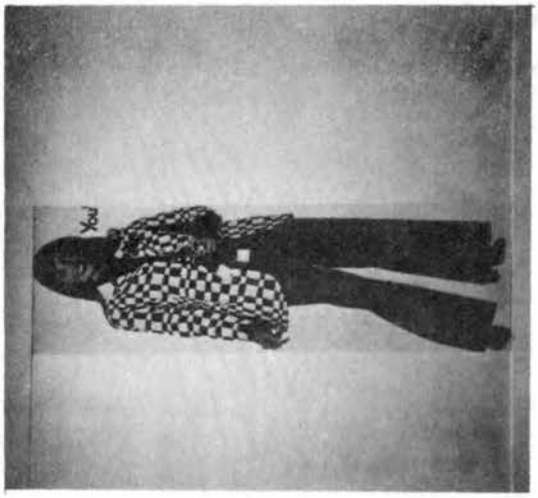


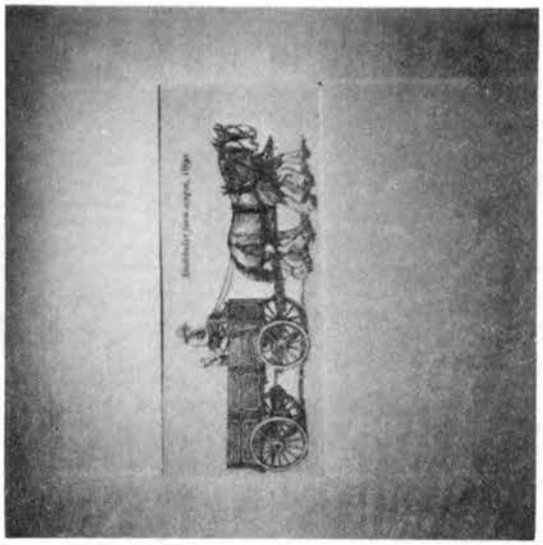
Illustration 6. Transportation in History

Child chooses photographs depicting three different modes of transportation--horse and buggy, train, and modern car.

_____25. Here are some ways to travel. Show me the oldest or "olden times" way.

_____26. Show me the newest way.

_____27. Put all three pictures in a row to show me the oldest way, then next, then the newest way.



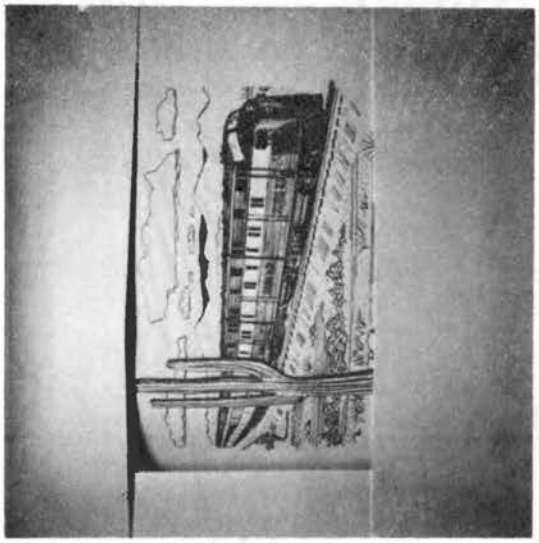


Illustration 7. Automobiles in History

Child chooses three photographs of automobiles, representing three historical periods--1900's, 1930's, and 1960's.

_____28. Show me the oldest car.

_____29. Show me the newest car.

_____30. Put all three cars in a row to show the oldest, then next, then the newest.


1938 MERCURY


1962 LINCOLN CONTINENTAL


1903 MODEL A

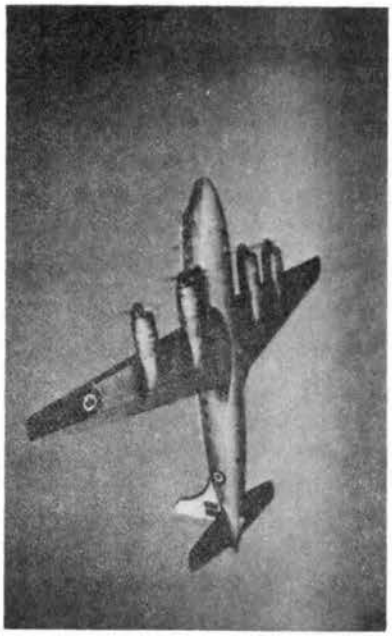
Illustration 8. Airplanes in History

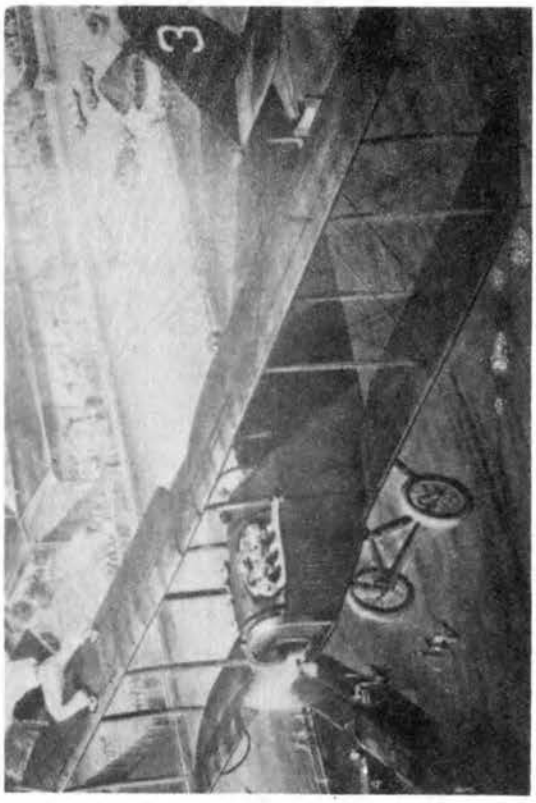
Child chooses three photographs of airplanes--the Wright Brother's plane, a turbo-prop, and a jet.

_____31. Show me the picture of the oldest airplane.

_____32. Show me the picture of the newest airplane.

_____33. Put all three airplanes in a row to show the oldest, then next, then the newest airplane.





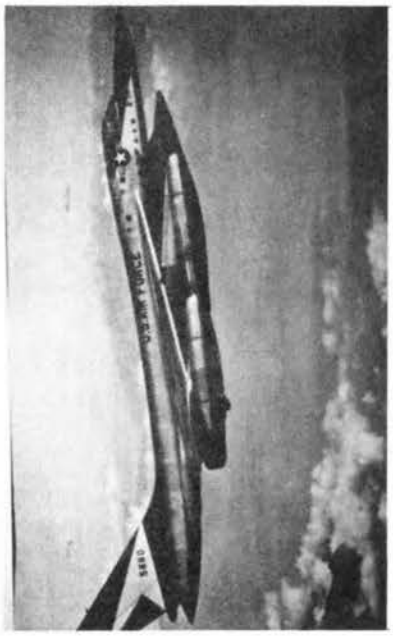


Illustration 9. Houses in History

Child chooses three photographs of houses--a log cabin, a two-story farm house of the early 1900's, and a one-story ranch style frame house.

_____34. Which is the oldest house?

_____35. Which is the newest house?

_____36. Put all three houses in a row to show the oldest house, then next, then the newest house.

_____TOTAL SCORE - Historical Time

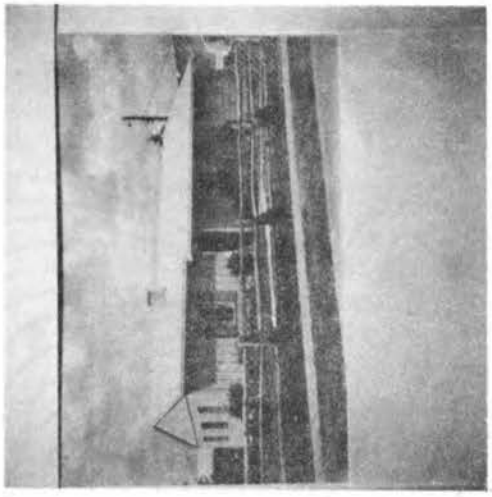


Illustration 10. Personal or Subjectively Experienced Age

Here are some pictures of a birthday party and a baby. Have you ever had a birthday?

_____37. How old are you?

_____38. When is your birthday? (accept month only, or month and day) _____

_____39. Will you be older or younger or your birthday? _____

_____40. How old will you be on your birthday? _____

_____41. Were you ever a baby? _____

_____42. (If subject answers, "yes") Were you a baby boy or baby girl? _____

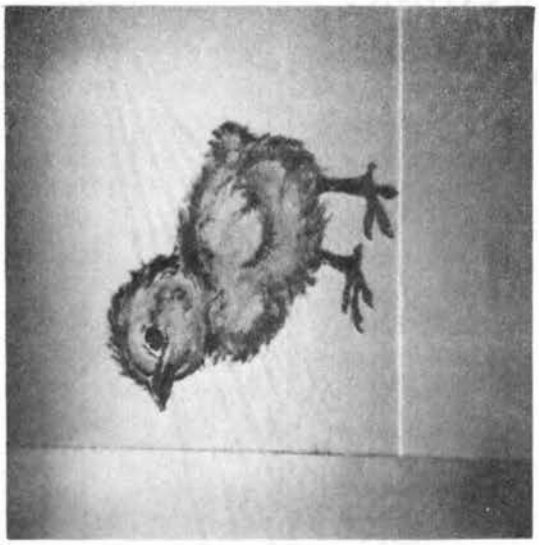
Illustration 11. Ages of Animals

Child chooses three photographs depicting growth of a chicken--a chick hatching out of an egg, an older chick, and a hen.

_____43. Show me the youngest chick.

_____44. Show me the oldest chicken.

_____45. Put all three pictures in a row to show how the chicken grew up.



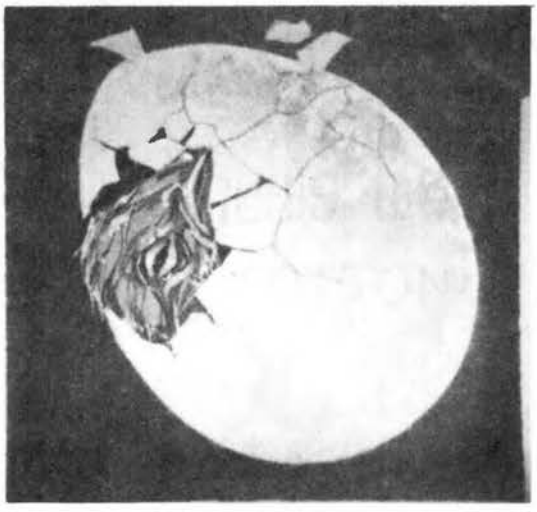


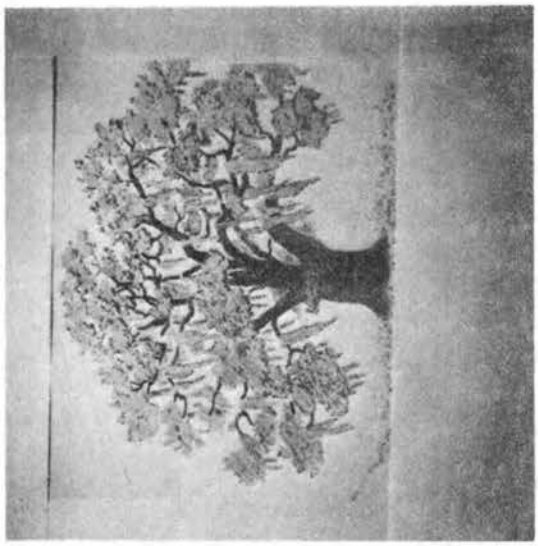
Illustration 12. Ages of Plants

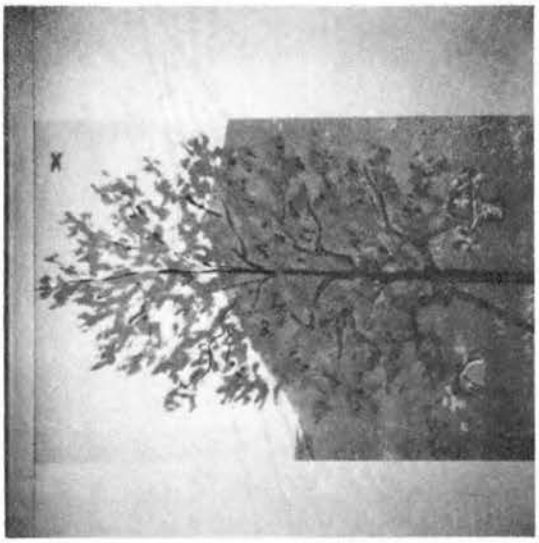
Child chooses three photographs of the development of a tree--a seedling, a young tree, and a decadent tree.

_____46. Show me the youngest tree, or baby tree.

_____47. Show me the oldest tree.

_____48. Put all three pictures in a row to show how the tree grew up and then got old.





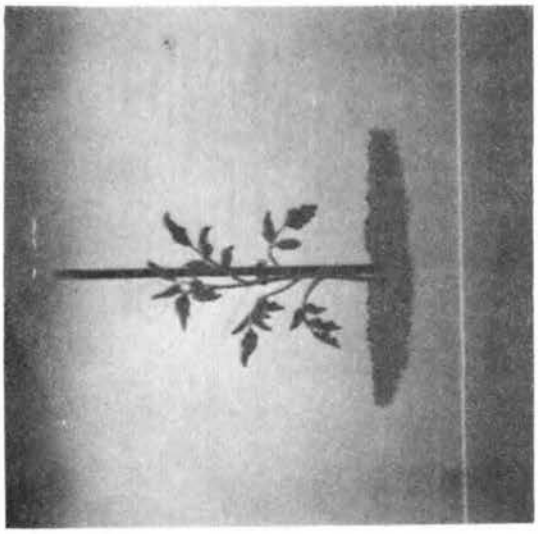


Illustration 13. Ages of People (Men)

Child chooses three photographs of males--a young boy, and adult, and an old man. Photographs are controlled for size and are in black and white.

_____49. Here are some pictures of men. Show me the boy, or the youngest one.

_____50. Which one is the oldest?

_____51. Put all three pictures in a row to show how the boy grew up and then became an old man.

Illustration 14. Ages of People (Women)

Repeat previous procedure for photographs of three females.

_____52. Here are some pictures of a woman. Show me the girls, or the very youngest one.

_____53. Which one is the oldest one?

_____54. Put all three pictures in a row to show how the girls grew up and then became an old woman.

_____TOTAL SCORE - TIME AND THE LIFE CYCLE

_____TOTAL TUT SCORE

Illustration 15. Open-Ended Questions

Here are some pictures of people who are old.

1. Do you know somebody who is old? ____ Who? _____

2. How can you tell he/she is old? _____

3. What makes people old? _____

4. Is your mother old? _____ 5. Your father? _____

5. Would you like to be old? _____ Why (or why not?) _____

_____

6. Do you think you will ever get old? _____

APPENDIX C

October 1, 1973

Dear Parents:

May I have permission for your child to participate in a research study on children's understandings of time? Preliminary research has indicated that children want to know more about time, the events of the past, and changes that occur in plants, animals, and people over periods of time.

To determine what children understand in these areas, I have created a 15 to 20 minute game in which children choose series of photographs from envelopes and identify seasons of the year, young and elderly people, young and mature animals and plants, and historical and modern styles of houses, transportation, and clothing. Children tested in a pilot study were enthusiastic about playing the game. Results of the study will aid teachers in planning learning experiences that will help children increase their understanding of time.

Your child has been selected to participate in this research. If you give permission for your child to participate, he will be interviewed at his school.

Thank you very much. Please feel free to call me if you have further questions.

Sincerely,

Judy Powell

OSU Ext. 6086

Home - 372-6267

_____ Yes, my child has permission to participate in this research.

_____ No, I would prefer that my child not participate in this research.

APPENDIX D

TUT

TIME UNDERSTANDING TEST

Name _____ School _____

Age _____ Birthday _____

Sex _____ Initial Test _____

Date _____ Re-test _____

Scoring: Score items 1 for a correct response, 0 for an incorrect response. The space at the right is for the subject's verbal response to the question.

General Divisions of Time

Day-Night

Child selects two photographs of the same outdoor scene, one showing day, the other night.

_____ 1. Show me the picture of day.

How can you tell it is day? _____

_____ 2. Show me the picture of night.

How do you know it is night? _____

_____ 3. Right now, is it day or night? _____

Yesterday, Today, Tomorrow, and Days of the Week

"The days of the week are Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, and Sunday."

_____ 4. What day of the week is today? _____

_____ 5. What day of the week is it at your house? _____

_____ 6. Was yesterday a school day? _____

_____ 7. What day of the week was yesterday? _____

_____ 8. Is tomorrow a school day? _____

_____ 9. What day of the week is tomorrow? _____

_____10. What day of the week is not a school day? _____

Season, Month, and Year

Child chooses four photographs, outdoor scenes depicting the four seasons.

_____11. Show me the picture of winter.

How do you know it is winter? _____

_____12. Show me the picture of summer.

How can you tell it is summer? _____

_____13. Which one is a picture of spring?

How can you tell it is spring? _____

_____14. Show me the picture of fall. (or autumn)

How can you tell it is fall? (or autumn) _____

_____15. Right now, is it fall, winter, spring, or summer? _____

_____16. Which season will come next, after this one? _____

_____17. What month is it? _____

_____18. What year is it? _____

_____ TOTAL (18 possible)

Historical Time

Animals in History

Child chooses photographs of a dinosaur and a cow.

_____19. Show me the animal that lived a long, long time ago.

_____20. Which animal lives now?

_____21. Do these animals (point to dinosaur) live today? _____

(If "yes," how do you know?) _____

(If "no," what happened to the dinosaurs?) _____

Clothing in History

Child chooses three photographs of a female in different styles of clothing--a costume of the late 1800's, the 1940's, and a 1970's pant suit.

_____22. Show me the picture of how women dressed a long time ago, the longest time ago of all.

_____23. Which one shows how women dress now?

_____24. Put all three in a row to show the one that lived the longest time ago, then next, until now.

Transportation in History

Child chooses three photographs depicting three different modes of transportation--horse and buggy, train, and modern car.

_____25. Here are some ways to travel. Show me the oldest or "olden times" way.

_____26. Show me the newest way.

_____27. Put all three pictures in a row to show me the oldest way, then next, then the newest way.

Automobiles in History

Child chooses three photographs of automobiles, representing three historical periods--1900's, 1930's, and 1960's.

_____28. Show me the oldest car.

_____29. Show me the newest car.

_____30. Put all three cars in a row to show the oldest, then next, then the newest.

Airplanes in History

Child chooses three photographs of airplanes--the Wright Brother's plane, a turbo-prop, and a jet.

_____31. Show me the picture of the oldest airplane.

_____32. Show me the picture of the newest airplane.

_____33. Put all three airplanes in a row to show the oldest, then next, then the newest airplane.

Houses in History

Child chooses three photographs of houses--a log cabin, a two-story farm house of the early 1900's, and a one-story ranch style frame house.

_____34. Which is the oldest house?

_____35. Which is the newest house?

_____36. Put all three houses in a row to show the oldest house, the next, then the newest house.

_____ TOTAL (18 possible)

Time and the Life Cycle

Personal or Subjectively Experienced Age

Here are some pictures of a birthday party and a baby. Have you ever had a birthday?

_____37. How old are you? _____

_____38. When is your birthday? (accept month only, or month and day)

_____

_____39. Will you be older or younger on your birthday? _____

_____40. How old will you be on your birthday? _____

_____41. Were you ever a baby? _____

_____42. (If S answers "yes)) Were you a baby boy or a baby girl? _____

Ages of Animals

Child chooses three photographs depicting growth of a chicken--chick hatching out of the egg, an older chick, and a hen. Photographs controlled for size.

_____43. Show me the youngest baby chick.

_____44. Show me the oldest chicken.

_____45. Put all three pictures in a row to show how the chicken grew up.

Age of Plants

Child chooses three photographs of the development of a tree--a seedling, a young tree, and a decadent tree. Photographs controlled for size.

_____46. Show me the youngest tree, or baby tree.

_____47. Show me the oldest tree.

_____48. Put all three pictures in a row to show how the tree grew up and then got old.

Ages of People

Child chooses three photographs of males--a young boy, an adult, and an old man. Photographs controlled for size and in black and white.

_____49. Here are some pictures of a man. Show me the boy, or the youngest one.

_____50. Which one is the oldest?

_____51. Put all three pictures in a row to show how the boy grew up and then became an old man.

Repeat above procedure for photographs of females.

_____52. Here are some pictures of a woman. Show me the girl, or the very youngest one.

_____53. Which one is the oldest one?

_____54. Put all three pictures in a row to show how the girl grew up and then became an old woman.

_____ TOTAL (18 possible)

_____ TUT TOTAL (54 possible)

Open-Ended Questions

Here are some pictures of people who are old.

1. Do you know somebody who is old? _____ Who? _____

2. How can you tell he/she is old? _____

_____

3. What makes people old? _____

_____

4. Is your mother old? _____ 5. Your father? _____

5. Would you like to be old? _____ Why (or why not?) _____

_____

6. Do you think you will ever get old? _____

VITA

Judith Anne Jourdan Powell

Candidate for the Degree of

Doctor of Education

Thesis: CHILDREN'S CONCEPTS OF GENERAL DIVISIONS OF TIME, HISTORICAL TIME, AND TIME AND THE LIFE CYCLE

Major Field: Higher Education

Minor Field: Family Relations and Child Development

Biographical:

Personal Data: Born in New Orleans, Louisiana, June 26, 1941, the daughter of Mr. and Mrs. Elliot Jourdan. Married Jeff Powell, June 15, 1963. Mother of one daughter, Anne Marie, age two.

Education: Attended elementary and junior high school in Madisonville, Louisiana; graduated from Covington High School, Covington, Louisiana, 1959; received Bachelor of Science degree from Southeastern Louisiana University, May, 1963, with a major in Home Economics Education and English. Attended Oregon State University, 1963-1964; attended Texas A & I University, summer, 1966. Received Master of Home Economics degree from Colorado State University, 1967, with a major in Child Development and Family Relations, and minors in Psychology and Consumer Economics. Completed requirements for the Doctor of Education degree, July, 1974.

Professional Experience: Junior high school English teacher, Lubbock, Texas, 1964-1965; First grade teacher, Sinton, Texas, 1965-1966. Teacher, Head Start Training Program, Colorado State University, summer, 1966. Head Laboratory Teacher and Instructor, Department of Child Development and Family Relations, Colorado State University, 1967-1968; Assistant Professor and Director of Child Development Laboratory, Humboldt State College, Arcata, California, 1968-1970. Instructor and Child Development Laboratories Teacher, Department of Family Relations and Child Development, Oklahoma State University, 1970-1971. Part-time instructor, Child Care Services Extension, Division of Home Economics, and part-time instructor,

Department of Family Relations and Child Development, Oklahoma State University, 1972-1974.

Professional Organizations: American Home Economics Association, National Association for the Education of Young Children, Association for Childhood Education International, Phi Upsilon Omicron, Omicron Nu, Southern Association for Children Under Six, Oklahoma Association for Children Under Six, Higher Education Alumni Council of Oklahoma.