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Hour Concept Learning in Pre-School Children

Faye Daines Campbell
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HOUR CONCEPT LEARNING IN PRE-SCHOOL CHILDREN

by

Faye Daines Campbell

A thesis submitted in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

in

Family and Child Development
ACKNOWLEDGMENTS

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ABSTRACT

Hour Concept Learning in Pre-School Children

by

Faye Daines Campbell, Master of Science

Utah State University, 1971

Major Professor: Carroll Lambert
Department: Family and Child Development

The effects of sex and tutorial instructions were studied as they influence the hour concept development of the pre-school child. The research was conducted at Utah State University Child Development Laboratories with twenty-two, three to five-year-old children enrolled at the time. Each child received three training sessions with the author.

It was found that the twenty-two children who had received individualized instruction on the hour concept showed a significant concept of a clock when the large hand was always constant on the numeral twelve.

The findings indicate that there was no significant difference between boys and girls on their ability to retain the hour concept from post-test 1 to post-test 2. No significant difference was found in the learning ability between boys and girls in this study.

(64 pages)
INTRODUCTION

Pre-school learning is one of the most discussed and debated subjects in the field of education today. With the increased number of programs devoted to the pre-school child the acquisition of knowledge in areas that previously have been devoted to elementary age students is currently being promoted for children at an earlier age.

With this development and the creation of programs to stimulate early learning processes, differences of opinion regarding the development of concepts as well as what factors have significant effect on the processes of learning have emerged.

One major area in which a majority of experienced and knowledgeable individuals hold conflicting views on instruction and learning of the pre-school child is in the area of development of the number concept. Piaget states that acquiring number concepts is a developmental process related to stages of development in which this capacity does not occur prior to the age of four. He also considers number concept development as being far more complex than the verbal use of numbers. The Piagetian theory emphasizes the child's readiness to learn about numbers—not his achievement. Piaget is not interested in number readiness as defined by arithmetic readiness tests but, rather, in children's awareness of fundamental properties of number, measurement and space. (Flavell, 1963)
Other views include those of Maria Montessori (Pines, 1966). Hers is a reality-oriented approach in which the number concept is taught through verbal statements and use of materials. Her equipment is designed specifically for teaching number properties.

The Bereiter and Englemann (Bereiter and Englemann, 1966) method also utilizes verbal repetition and rote learning. This method advocates earlier exposure and instruction in the development of number concept and the age level limit established by Piaget has been lowered.

Such researchers give support to the views of Bruner (Pines, 1966) who believes most anything can be taught to a young child if it is taught in a way comprehensible to him.

The various theories and methods of instruction in number concepts are pertinent to research in teaching the hour concept since it will be necessary for the children to be able to recognize and identify the number from one to twelve if they are to deal with hours of the day.

In a study by Springer (1952) on hour concept, no four year old children could correctly state the hour indicated on a clock in a basic test. This would affirmatively relate to the Piaget theory that number concept cannot be achieved until four years, any time and hour concept would consequently be attainable prior to that age, or until after the number concept had been learned.
STATEMENT OF PROBLEM

The problem to be investigated in this study is the influences of a training experience on the four-year-old child's ability to learn the time concept of the hour.

Objectives

This exploratory research will deal with the factors of the child's sex and age in an attempt to assess what role they each play in the development of the concept of an hour. This research also will attempt to determine if training with a designed instruction approach can help accelerate the development of the young child's concept of an hour.

Hypotheses

The hypotheses to be investigated in this study are:

That with a given amount of instruction the pre-school child will be able to recognize the hour concept of the clock.

That the girls will learn faster and retain more of their learning than will be true of the boys.
REVIEW OF LITERATURE

The main areas covered in this representative review of literature are:

1. Number concept development
2. Time concept development
3. Clock and hour concept development
4. Effects of color on concept development

Number Concept Development

A great deal of emphasis has been placed recently on number concept. Many studies have been conducted concerning this area of development in the young child.

Piaget stands out as a major influence in this area. His hypothesis states, "... the construction of number goes hand-in-hand with the development of logic, and that the pre-numeral periods correspond to the pre-logical level." (Piaget, 1952, p. vii)

According to Piaget, this first stage is found in the two to four-year-old in which the child is egocentric and will judge things as they appear to him. Cause and effect relations are also beginning to develop at this age. However, these are not interpretations, but are based on the child's perceptions. The child has achieved a sense of object permanence and a sense of self; these concepts must be developed before he can move on to the next steps of grouping
objects and of being able to recognize a whole, its parts, and the relationship between them. Piaget (1941) gives a further description of number concept in the child in which he groups the development into three stages. The first stage, global comparison, appears at about the age of six; the child develops a spontaneous interest in numbers, ability to count and perceptually determine numerical judgments. The second stage, or intuitive stage, is one year later in which the child starts to realize that number is an attribute of objects that does not vary with perceptual transformations. This is followed by the third stage of numerical judgments and operations becoming stable, consistent, and the child has a notion of reversibility. The ability to perform operation develops approximately two years later when the child is ten.

Dodwell states the need of the child to be able to manipulate and make judgments about perceived patterns that will not influence his judgment of the number. The child must be able to seriate and classify objects on the basis of a specific attribute, such as size. Dodwell further elaborates on the necessary skills in developing number concept by stating:

Specifically, operations which are necessary conditions of an understanding of numbers are, according to Piaget, the ability to deal with the equivalence of cardinal classes in terms of one-to-one correspondence, and the ability to deal with transitive relations such as "greater than" and "less than." (Dodwell, 1960, p. 193)

Lovell states that "Piaget's concept of number is based on the formation and systematization in the mind of two operations; classification and seriation." (Lovell, 1961, p. 29) Before these operations can become stable the child must
be able to understand the concepts and then move to the abstract, a skill which Piaget feels begins to develop early in the child through a process of trial and error.

Both Elkind (1964) and Weaver (1967) stated that classification, grouping and ordering, are very necessary in the child's development of number and other mathematical concept. Elkind (1964) states the importance of understanding reversibility when the child considers the whole and the parts as well as inclusion of elements in more than one class.

Maier (1965) also stresses the importance of conservation and counting ability in the understanding of number concepts, as do authors Wohlwill and Lowe (1962) when they tie counting experiences into the development of conservation.

Two authors that have used Piaget's theories as bases of their studies and have arrived at different findings are Estes (1956) and Dodwell (1960, 1962). In her testing of 52 children, age four to six, Estes found no stage development, the subjects could either count and respond to the test operationally, or they could not count and did not respond in terms of numbers.

In Dodwell's studies (1960, 1962), he refuted the findings of Estes and showed the three stages described by Piaget as global, intuitive and concrete operation. In the second study (1962), Dodwell utilized Piaget's classification and conservation method and confirmed the original findings of stage development of numeration. However, Dodwell does not feel that the stages are as rigid as Piaget reports them to be.
Number concepts appear to be influenced by cultural factors as studies by Halaza (1967), Hyde (1959) and Mermelstein (1965) concluded. Halaza's study (1967, p. 206B) involved disadvantaged children and concluded, "Understanding of relational quantity terms and rote counting ability were not totally sufficient for judgment of equivalence." Hyde (1959) found Piaget's stages to be consistent when applied to her subjects, but at different ages. European children, as an example, learned the understanding of numbers faster than non-European, and the author attributed this to cultural factors. Mermelstein's study involved children who had had no formal schooling. He found that subjects lacking in language and who were unable to pass verbal tasks were able to pass non-verbal tasks. As with Hyde's study, Mermelstein found Piaget's sequence of stages to appear; however, he found that the lack of formal schooling did not affect the age of number concept development. Another study conducted by Wohlwill (1960) showed number knowledge and mastery of tasks are not related or due to learning tasks or experiences in school. Children who had no formal schooling and were low in I.Q. could count and work with numbers. He found that tasks are definitely related to age; however, as with Dodwell (1962) and Elkind (1964), no sex differences were found in the development of the early stages of number concept.

A research in number concept development of mentally retarded children was conducted by Terada (1967) who found that the stages as defined by Piaget did exist but at a much slower pace than the normal child and that perceptual judgments seemed to dominate judgment of the retarded child.
Other authors have concluded that the ages Piaget defines are too restrictive, as Braine (1964) found in his subjects who developed two years behind the defined ages. Dodwell (1961) and Peters (1967) both agree with this finding.

More strongly objecting to the emphasis placed on Piaget's conclusions is a team of researchers consisting of Fujinaga, Hisatake and Hosoya (1964) who feel that Piaget does not give early training in the home the importance that it indeed has in the development of number concepts.

The question arises as to when should the education of number concept appear in the school system. Brownell's study of 1941 has shown that children already possess many number concepts before entering first grade. Bjonerud (1960) reported specific number concepts possessed by pre-school children at the time of kindergarten entrance and recommended systematic instruction beginning no later than second semester in the kindergarten year. Davis (1959) studied the growth of familiarity with measurement in children of four and five years of age. Sussman (1962), in a recent study, has shown that today's kindergartners know as much about arithmetic at the beginning of kindergarten as first-grade children did a few decades ago. Dutton states that, "Today apparently there are forces at work which are enabling pre-school children to learn and use more arithmetic than in any other period of our educational history." (Dutton, 1963, p. 252)

This increased understanding and use of arithmetic by pre-school children has been accompanied by supporting evidence supplied by researchers in
early childhood education suggesting improved teaching procedures and revised curriculum planning. Swenson (1961) has shown the relationship between meaning and organization, pointing out that if the results of learning are to be useful, they must be organized. Stern (1949) believes that if the child's interest is aroused, and if teachers have new ways of letting him discover arithmetic, there is no need to postpone the teaching of numbers or to simplify the curriculum. Writers such as Lambert (1958) and Deans (1954) point out that it would be impossible to keep arithmetic out of kindergarten because the four and five-year-olds need number concepts in order to carry on their small affairs. In spite of these findings little change in the arithmetic program for kindergarten and first grade has been initiated in the past two decades.

**Time Concept Development**

Harrison (1934) states that among the learnings which a child must acquire in his early years is the ability to understand time. These concepts are developed through experience with perceptive activities.

Concepts of young children develop slowly because of their lack of extended experience; time concepts are extremely slow because they are abstract. Farrell puts it this way; "When one considers that the education of children is more meaningful through concrete and sense appeal than through the abstract, the difficulties experienced by the child in comprehending time are evident." (Farrell, 1953, p. 589) He feels that time is an important concept used in the lives of children and that it must be developed through a number of indirect
perceptual experiences, often unrelated in themselves, that have the common factor of time, because the time concept itself is too abstract.

Nulton (1953) in her article states that time is man created; the child cannot feel, taste, smell, hear, handle or even see time. Small wonder that to the little child time has no meaning; to them time must be now.

Harrison (1934) states in her article that the process of language development is influential in time development. The understanding of the term before and after must be developed as time concepts are developed. More important is the growth of number concepts since concepts of time are dependent on the growth of number meanings and relationships in the child's thinking.

The first indication of a sense of time in young children as recorded by Decroly and Degand in the article by Harrison (1934) are developed by simultaneities, that is the sight of a person coming to a child at a certain time indicates to the child that a bath is to be given. The immedicated past is next distinguished and understood according to the development of memory.

Oakden and Sturt (1922) report that the growth of knowledge of conventional time—such as time of day and periods past and ahead—is a:

result of a gradual process of learning not due to some innate faculty or acquired suddenly in the course of infancy or childhood. The learning proceeds partly by contact with adults who already know the use of the different time words, and partly through definite teaching in such subjects as history. Oakden and Sturt, 1922, p. 309)

Early perceptions are noted in children as young as four years, reaching full comprehension at about thirteen or fourteen years. Binet's (1916) observations on the subject are well known. In his 1906 scale he ascribed to children of six
years the knowledge as to whether it is morning or afternoon; at nine the child knew the days of the week, the month, day of month, and year; at ten the child can repeat names of months correctly.

Bradley (1947) conducted a study to trace the growth of ability to understand the ordinary time words used in everyday life and the development of the conception of a universal continuous time scheme extending into the past and the future by school children of five years and upward. The results indicate that "at the age (5) the average child's understanding of a conventional time-scheme is very meagre, so far, at least, as being able to express his knowledge in answer to questions is concerned." (Bradley, 1947, p. 77)

After the age of five there is a general order of development in which definite stages are successively achieved. In general, the capacity to understand the conventional time-scheme and to use particular time words correctly comes later in development than usually believed.

Ames (1946) conducted a study based on a systematic compilation of the verbal expressions of time in the young child from the age when he first responds to the simplest words or phrases implying time. She used two methods in her study: (1) observation of child, and (2) asking questions dealing with various aspects of the concept of time to the children. In this study Ames (1946) found marked individual differences appear within any one level of age and intelligence in different children's orientation in time. In spite of these individual variations, it appears that time concepts come into use in a relatively uniform sequence from child to child, and at least the same relative time in the life of every child. She found that words which indicate the present
come in first, then words indicating the future, and finally those indicating
the past. Thus "today" (24 months) precedes "tomorrow" (30 months),
which in turn precedes "yesterday" (36 months). According to Ames (1946,
p. 122), "complete mastery of any one time concept does not appear all at
once. Rather, there are several different levels of attainment. First the
child can respond suitably to a time word as by waiting. Then he can use the
word spontaneously, and finally can answer correctly questions dealing with
the concept." This study found that children can tell what time a thing happens
in terms of some activity before they can give an actual clock time. Similarly,
individual time words are spontaneous in terms of specific context before they
can be generalized.

Dutton (1967) found that environmental factors influence the culturally
disadvantaged child's concept and use of time. Irregular working hours of
parents and different school schedules make the sequence unrepeated. Dutton
states that,

when the child's events are sequenced at home or at school
the child begins to formulate his concept of time. . . . when
sequenced events are repeated, children may accept these
sequences as standards for work or play and for comparing
time. These experiences help the child in his development
of time concepts and the measurement of time. (Dutton, 1967,
p. 358)

He found that the disadvantaged kindergarten pupils were almost entirely
unaware of time, time schedules at home or school, or the need for time.
Oaken and Sturt write,

The growing sense of time in children has been studies through their vocabulary--a method which, though probably the best yet tried, suffers from the disadvantage (especially in the youngest children) that the inability to use a word correctly does not always mean that the experience connated by the adult use of the word is lacking. (Oakden, Sturt, 1922, p. 310)

Lovell (1961) evaluated children's development of concepts of time and pointed out the importance of teaching all children to tell time. He noted the fact that we do not as yet know the best means for helping children to develop their concept of time.

**Clock and Hour Concept Development**

Few studies have been conducted in teaching the actual clock or hour concept to the kindergarten or pre-school child. The single author who has done extensive research and conducted many studies in this area is Doris Springer (1951 and 1952). Her subjects were 89 children ranging from four through six years of age who had not been given any instruction in school in telling time. Individual interviews were conducted by the author. The child was first asked questions concerning the time of three events in his daily pre-school schedule. He was then shown the large clock and asked the time, and finally was asked to set the clock at the present time himself.

The proportion of children who were able to tell time increased at each successive age level. The four-year-olds were not able to tell the time shown except for a few correct responses for eight and ten o'clock. The hours were
least difficult to identify, the half hours next and the quarter hour the most
difficult.

At each age fewer of the children were able to set the clock correctly
than were able to tell time. Practically none of the responses of the four-
year-olds were accurate. As in the case of telling time, the children were
more accurate in setting the hours than in setting half and quarter hours.

It was also found that incorrect counting was responsible for a fourth
of the errors, and inaccurate identification of numbers was a common error
for younger children.

From this study, Springer (1951) classified the steps in development of
telling time as: first, the child is able to tell the time of activities which occur
regularly in his daily schedule; second, the child is able to tell time by a clock
including the hours, then half and lastly quarter hour; third, he is able to set
the clock in the same sequence as telling time by the clock; and fourth, he is
able to explain why the clock has two hands.

In a second study conducted by Springer (1952), each child was given
a large sheet of paper and a pencil and was asked to draw a clock. The majority
of the children at each age drew a plain circle. Very few of the children made
drawings which could not possibly be regarded as representative of a clock.
The hands on the clock were called "hands" by the majority of the children of
all ages and approximately one-half of the four-year-olds put two hands on the
clock that they drew. The knowledge that the clock should have one long and
one short hand was revealed in the drawings, or usually in the accompanying comments given.

Additional differences in the three age groups were observed in the writing of the digits. Included in variations were the written number, the proportion of reversed digits, the direction in which they were written, and the spacing of the digits.

None of the four-year-olds made over one-half of the digits needed on the clock but they revealed in their spontaneous comments a knowledge that digits were necessary. At least 75 percent of the four-year-olds that made no digits said either "numbers" or "names" were needed.

In the final test given, that of directed to naming hours, age differences were more apparent. None of the four-year-olds could correctly state the time shown on their clock.

Springer states at the end of her study,

With this sample and technique, even the youngest subjects, with few exception, reveal in their drawings some knowledge of the clock. There are, however, definite trends discernible in the drawings which show an increasing maturity of ideas and of ability to express them with the increasing in incidental experiences and observations which are associated with an increase in age. (Springer, 1952, p. 53)

From this study, Springer defines the stages of development in the concept of the clock as:

Stage 1: No evidence of any knowledge of a clock

Stage 2: Knowledge of the shape of a clock as shown by a circle, but other aspects of the drawing inappropriate

Stage 3: Knowledge of shape of clock, and of hands but incorrectly placed
Stage 4: Hands correctly placed, and the necessity for additional marks which are placed at random

Stage 5: Knowledge of hands and frequently with one long and one short, occasional numbers which are located around the edge of the clock

Stage 6: Knowledge of numbers written around the edge of the clock sometimes written in a counterclockwise direction with either too many or too few numbers written

Stage 7: Correct numbers one through twelve, beginning usually with one, in the correct position and direction but not correctly spaced

Stage 8: Knowledge of a variety of shapes of clocks; of hands; one short and one long, placed correctly; of numbers, one through twelve beginning either with 1 or 12, and numbered in a clockwise direction and carefully spaced so that 3, 6, 9, and 12 are in position.

A study conducted by Engel and Hamlett (1954) indicates that in the group of second-grade school children tested with a clock with movable hands and a calendar, there was a significant sex difference. "The mean score of males on the clock section is higher than that of females; on the other hand, the female mean score on the calendar is higher than the males." (Engle and Hamlett, 1954, p. 657)

Kelly (1957) states necessary requirements of material used in teaching the time concept. The clock should be large enough to be seen at room distance and the hands on the clock should be flexible enough to be operated easily by little children. As a result of this study, Kelly feels that accurate telling of time should not be introduced in kindergarten. Essentials taught at the kindergarten level should be: (1) a clock has two hands, a short and a long one;
(2) the short hand tells the hour; (3) there are numbers on the face of the clock; and (4) the hands of the clock move around from one number to the next in a forward direction.

Effects of Color Cue

Brian and Goodenough conducted a study to determine, "Whether the perception of color or the perception of form plays a major part in the total apprehension of an object." (Brian and Goodenough, 1929, p. 197) The subjects for this study were taken from three age groups; first, the nursery school age from twenty-two months to five years; second, elementary school children ranging in age from six to fourteen years; and third, a group of 40 adult women. From the study they concluded:

It is evident that there is a certain period of life during which color appears to be accorded greater relative significance than at any previous or succeeding age-level. This period begins at about the third birthday or slightly before and continues until about the age of six years. The tendency appears to reach a maximum at approximately four and one-half years. (Brian and Goodenough, 1929, p. 205)

In this study the authors found no constant sex differences shown by their subjects at any age level.

Kagan and Lemkin (1961) found in their study of subjects ranging from age 3-9 to 8-6 an indication that the pre-school child's understanding of the term, "same as," is influenced primarily by the shape or form of the objects rather than its color or size for both boys and girls. The author found that "form was distinctively preferred to color as a basis for similarity and that color was preferred to size." (Kagan and Lemkin, 1961, p. 28) For boys
there was no age difference in this response pattern. However, the authors found older girls were less likely to use color as a basis for conceptualization than younger girls; older boys were more likely to use color than were the older girls. Kagan and Lemkin concluded from this study that matching preference was related to both sex and age.

Lee (1965) found that six-year-olds are capable of using the concepts of color and size; however, as Brian and Goodenough (1929) found, the child of this age is less predisposed to use these concepts since the child is now aware of other aspects which could be used in classification of objects and color and size had lost their importance.
METHODS AND PROCEDURES

Setting and Procedures

The data in this study came from a sample of twenty-two children attending Utah State University Child Development Laboratories. They were selected by the researcher on the basis that first, they already know the numbers one through twelve. This was determined by a test which consisted of using small, 3" by 5" index cards that had a number printed in black. The numbers ranged from one through twelve. Each child was allowed to miss no more than four numbers. The second requirement for use in the sample was that the child could not already understand the concept of the hour. This was determined by a test given with an alarm clock in which the child was asked to identify four hours, one o'clock, three o'clock, five o'clock and eleven o'clock. If he correctly responded through verbal answers to two or more hours, he was not used in the main study. Both of these tests were given to the entire population of the Child Development Laboratories of 80 children, which were attending either the morning or afternoon laboratories Spring Quarter of 1971.

During this study there were four pre-school groups during the school year that met Monday through Thursday each week for approximately two and one-half hours a day. There are two rooms in the Family Life Building where these pre-school classrooms are. Each room had a morning and an afternoon group which consisted of twenty children, ten boys and ten girls, ranging from
three to five years of age. These children came from homes in Logan City and nearby rural communities. There was a variety of parental occupation in the homes ranging from professionals to university students. These children might be considered to come from an average middle class home environment. Each laboratory also had one head teacher who is part of the faculty or a graduate assistant and four student teachers.

**Instruments**

The clock used during the training sessions with the children was designed by Visual-Motor Perception Teaching Materials. It is part of the "Concept Clocks in Color" program. Although their program is designed with two clocks, this study only used the first concept clock since the author was only interested in teaching the hour concept. The clock is drawn on a hard cardboard square surface 10" by 10"; it is outlined in black making a circle measuring 8". The center of the circle is white with large black numerals from one to twelve printed around the edge. The hands of the clock are movable; the hour hand is short and red in color; the minute hand is longer in length and blue in color. There is a cardboard stand attached on the back of the clock to allow a standing position while the children are working with the hands.

**Administration and Collection of Data**

The data was gathered during a three-week period beginning April 27, 1971, and ending May 18, 1971. During the free play periods the individual
children selected for the study were asked by the researcher if they would like to go with her and play a game in another room. They were assured that it would not take long and that they would be brought right back to their room and they could continue their play. The majority of the children attending the afternoon sessions were familiar with the researcher. In the morning sessions the researcher first found it necessary to become acquainted with the children either in the laboratories during free play or by devoting the first session to just free conversation to allow the children to get acquainted with the author.

The investigator and the child went into the Child Development Library. It is a room approximately twelve feet square in which books, pictures, records, and music instruments for the Child Development Laboratories are kept. In the center of the room is a child-size table with two child-size chairs. The children performed the tasks while seated at the table beside the author. The concept clock was already placed on the table when the children came into the room.

When the child first entered the testing room the investigator reinforced the idea that this was a game and they were going to have fun. Also, before starting the first session in which the tape recorder was used, the child was shown the recorder and was asked to say his name and then it was played back for him. The rest of the sessions where a data sheet was used the researcher placed the sheet on the table. The child was told that this paper was going to be used for keeping score on the game.

The children met with the researcher six times; the first session was devoted to the pre-test and becoming acquainted. In the last two sessions,
post-test 1 and post-test 2 were given. For each child no longer than two days lapsed before meeting again with the researcher for the next training session, except with one child who was absent from the laboratory for one week. Also, in the post-tests the author allowed a longer time laps. Post-test 2 was administered one week after post-test 1. This was done so that the author could observe if retention of the hour concept did occur. The children were not taken out of their rooms for any session longer than six minutes.

This study was limited to teaching only the hour concept to the children. For this reason, the big hand, or minute hand, was always placed at the number twelve by the author. It was not the intention of this study to teach the function of both clock hands, or inbetween times. The child was never asked to respond to the time when the minute hand was not on twelve.

Pilot Study

The author conducted a pilot study to determine the correct procedures that would be used with the experimental group throughout the study.

The pilot study was given to four children, two males and two females, during the week of March 8th through 10th, 1971. Originally, the author was using six children but two children, one male, one female, were absent during the last session of the post-test and, therefore, had to be eliminated.

During the pilot study the author used the annex to the parent room in the Child Development Laboratory. Each child was met separately for three
consecutive days. Because of the larger sample used during the study the children were not met consecutively; however, no more than two days lapsed before the next session with the author.

Because of the small number of children used for the pilot study both their knowledge of numbers one through twelve (using the 3" by 5" index cards with the numbers printed individually on the cards) and their understanding of the time concept of the hour were investigated in the same session. The author found that because both tests are so short they could be given in the same session and still not take the children out of their group for over six minutes. This also allows the author some time to acquaint herself to the children and the children to her. It was interesting to note that if the children are still shy and nervous with her, they tend to say, "I don't know," to any question asked.

The four children in the pilot study were all over four years of age, male A was 4-6, male B 4-7, female A 4-6 and female B was 4-6. The subjects were students at the Utah State Child Development Laboratory attending for their second quarter. Two children were attending the morning session and two were attending the afternoon.

Originally, the author began eliminating the children unless they recognized all the numbers. However, this had to be amended to find enough children even for the pilot study. If the children recognized ten of the twelve numbers, they were used. Of the four children used in the pilot study, it was found that only female B recognized the numeral eleven; none knew the numeral twelve. Male A called eleven 101 and twelve 102; female A confused the nine and six;
with the exception of these errors they recognized the rest of the numerals.

None of the children tested in the pre-test understood the hour concept. At
the end of the sessions when given the post-test on the hour concept, only male
B missed one of the hours. The other three children had a perfect score on
the alarm clock test of the time concept.

Through the pilot study the author became aware of some corrections
that needed to be made with the data sheets. For convenience, the size needed
to be cut down and have each session printed on one side of the paper. The
wording of the questions needed to be changed to allow more direction and still
allow freedom in the answers. For example, when asking the hour that the
hand is pointing to the author originally said, "What is the hour?" This was
changed in the study to say, "What hour is the short, red hand pointing to?"
This allows far more guidance and description given to the child, and also re­
inforces the concept of the hour hand being short and red.

It was found necessary to anchor the visual-motor perception clock so
that when the subjects were examining the clock and later moving the hand, it
would remain standing. As the children used the clock it had a tendency to fall.
When this occurred the subjects became frustrated and embarrassed.

The pilot study proved very beneficial and interesting, and from the
results the following procedures were changed in this way: (1) the number
knowledge test and pre-test were given in the same session; (2) not more than
two days passed before the next session with the subject; (3) the wording of the
author's questions were changed to be more descriptive; (4) visual-motor per­
ception clock was anchored during the sessions.
The study was originally designed to have both an experimental and control group of twenty children, in order to determine if training with a designed instruction approach could help accelerate the development of the young child's concept of an hour, in comparison with children who have not had the training periods. However, after the author administered the two tests previously mentioned, the test on knowledge of the numbers and the test on the knowledge of the hour concept, she found only twenty-two children from the entire Child Development Laboratories that qualified for the research. Only three children were disqualified because of existing knowledge of the clock and hour concept. The remaining children were unable to recognize eight of the twelve numbers from one to twelve. The research was adjusted to be exploratory, to discover if the hour concept could be taught to these twenty-two preschool children.

**Main Study**

Twenty-two children were selected from two morning Child Development Laboratories and two afternoon Child Development Laboratories at Utah State University. The children were given a pre-test to evaluate their knowledge of the concept of the hour and also their number knowledge.

**Pre-test**

Each child was taken individually by the author, who conducted all sessions, into a room apart from the actual laboratory. This room is the Child Development Library. The child was seated at a child-size table. On the table
was an alarm clock with the crystal removed. The clock was set to read one o'clock. Also placed on the table was the data sheet. After the child was seated at the table the experimenter said, "Today we are going to play a game. The paper that I have here is to keep score. The clock on the table is telling us the time. Can you tell me what time it says?" After the child answered, the author did not correct the child if the answer was wrong. The author would move the hour hand to three o'clock, ask the child to tell what time it was saying and then move the hands to five o'clock and finally eleven o'clock.

After completing this test the author introduced the 3" by 5" index cards with the numbers printed on them. A more complete description is given on page 19. The author said, "Now we are going to play a game with numbers. I will hold up a card and I would like you to tell me the number printed on the card." The cards were not put in counting order, but in a random order so as not to allow correct responses when rote counting. The child's answers were not corrected if he gave a wrong number.

The author then turned on the tape recorder, first letting the child say his name and then playing it back for him. Then the author asked the child, "What does the clock tell us?" After the two tests were administered and these two questions were asked, the author then just talked with the child to become better acquainted.

Procedure 1

The child was taken from his room during a free play period and accompanied the author into the Child Development Library. On the child-size table was placed the color concept clock (a more detailed description is given on
The experimenter began, "We are going to play a game. On the table I have a clock." With the author's guidance the child was encouraged to examine the clock's parts and structure. The investigator asked the child to move the hands of the clock and to trace the outside of the clock and to recognize the numbers by counting them.

The author asked the question, "What do you see?", to reveal the thoughts the child was formulating. The child was encouraged to tell the author as much about the clock as he could; the shape, the numbers, the color of the hands, the size of the hands, and the numbers around the clock.

The author then moved the hands of the clock to read four o'clock. The author said, "The clock says four o'clock." While the author pointed to both hands simultaneously, she said, "These are the hands of the clock." The author placed one finger near the arrow point of the short, red hand and the number four. The author said, "What color is this clock hand?" The author allowed the child to respond. If the child did not know the color or gave a wrong answer, the author would say, "It's the red hand." The author then asked the child, "Is this hand longer or shorter?" The child was given time to respond. If the child was incorrect, the author would say, "This hand is shorter." The author would then say, "The short, red hand points to the hour."

The author then asked the child to point to the short, red hand, to trace the hand with his finger, and to stop at the point of the hand. The author said, "What number is the short, red hand pointing to?" Again if the child was wrong, the author would correct the child. The author said, "The short, red hand is
pointing to the hour; can you tell me what hour it is?" The child was given time to respond. The author then said, "The short, red hand is pointing to the number four, so the clock is telling us that it is four o'clock."

The same procedure was followed with a second hour; the short hand was moved to seven o'clock.

Procedure 2

When the child came into the Child Development Library, the color concept clock was again placed on the child-size table in an up-right position with the clock hands showing three o'clock. The author first encouraged the recognition and identification of the parts of the clock. The author asked the child to tell her all about the clock. If the child was hesitant in answering, the author would say, "Can you tell me the shape of the clock?", "How many hands does the clock have?", and other questions related to the clock.

The author then asked the child to begin with the number one and count the numbers around the clock. The child was asked to point to each number as he gave the name. The author then pointed to the short, red hand and said, "The short, red hand tells us the hour; will you point to the short, red hand?" Now can you move the short, red hand to the number four?" During this time the author has kept the blue hand to the number twelve. If the child would not move the hand, the author would take the child's hand in hers and move the clock with the child. The author then said, "The clock says four o'clock."

The author moved the short, red hand around the face of the clock in a clockwise direction; while moving the hand the author said, "The hand goes around the clock; will you move the hand with me?" As the hand was being
moved the author said, "The hand moves around the clock in this direction, the same way we counted the numbers."

The child was then directed to stop the short, red hand on the number five. The author said, "The clock says five o'clock; can you show me the hand that tells the hour?" "What times does the clock say?" If the child was incorrect, the author would go back and have the child move the hand around the clock and stop on five, and then give the same directions.

The author did the same procedures having the child stop on the seven.

Procedure 3

This session with the child was a review and the author did the same procedures as in procedures 1 and 2.
FINDINGS

Presentation of Findings

In this study, twenty-two pre-school children were given a pre-test on the hour concept recognition, asking four separate hours: one o'clock, five o'clock, eight o'clock and eleven o'clock. Then each child met with the author for three training sessions, after which a post-test was administered. One week later a second post-test was given to each child.

The presentation of the findings will be described under the two hypotheses that were tested by the author. Following the presentation of the findings a discussion of each session will be accompanied by tables which have been included to clarify specific points and to allow for comparisons of the data.

After an analysis of the data gathered in this study, the author has found evidence to conclude with the following findings.

Hypothesis I

Hypothesis I states: That with a given amount of instruction the pre-school child will be able to recognize the hour concept of the clock. The results indicated that twenty-one of the twenty-two children in this study increased their knowledge of the hour concept.

Eleven children on the pre-test did not know any of the four hours asked by the author. Table 1 shows their improvement on post-test 1 and post-test 2.
Table 1. Pre-test score of 0 on hour concept as compared to post-test 1 and post-test 2 scores (N=11)

<table>
<thead>
<tr>
<th>Number of correct responses made</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post-test 1</td>
<td>0</td>
<td>1</td>
<td>4</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Post-test 2</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>6</td>
<td>2</td>
</tr>
</tbody>
</table>

Of the eleven subjects who received 0, or no correct responses on the pre-test, one child received one correct on post-test 1, four children were correct in response to two of the hours asked, three subjects answered three correct hours, and three children received a perfect score of four correct responses. Only two children received a lower score on post-test 2 than they did on post-test 1. However, two also received a higher score on the second post-test than they did on the first post-test.

Eleven of the children on the pre-test received one correct response to the hour concept. Table 2 shows their improvement on post-test 1 and post-test 2.

Similarly, findings were found with the eleven children who were correct on one hour of the pre-test and those who were not correct on any hour. Only one child showed no improvement on either post-test 1 or post-test 2,
Table 2. Pre-test score of 1 on hour concept as compared to post-test 1 and post-test 2 scores (N=11)

<table>
<thead>
<tr>
<th>Number of correct responses made</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post-test 1</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Post-test 2</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>5</td>
<td>4</td>
</tr>
</tbody>
</table>

receiving the same score of one correct response throughout the study. Three subjects increased their score to two hours correct on post-test 1, four children gave three correct responses out of four hours and three children received a perfect score of four hours correct on the first post-test. With this group of subjects there was an increase of correct scores on post-test 2. Two children gained in correct responses over post-test 1, both knowing one hour more than what they did on post-test 1.

Of the children used, twenty-one of the twenty-two children increased their knowledge of the hour concept from the administration of the pre-test to that of the post-test 1. Two children decreased in number of correct responses from post-test 1 to post-test 2. However, three children increased in correct responses from post-test 1 to post-test 2.
From these findings, then, the author concluded that the first hypothesis was proven. The author was able to teach the hour concept of the clock with the given amount of instruction to all but two of the children used in this study.

Hypothesis II

Hypothesis II states: That the girls will learn faster and retain more of their learning than will be true of the boys. The results of this study indicated that there was no significant difference in the learning or retaining ability of boys and girls.

The author used the independence of principle test at both the .05 and the .10 level and in both the results showed no significant difference.

The independence of principle test can be used to test whether or not two or more observed groups are different at a certain level (.05 and .10, in this instance).

Method: The actual frequencies are computed and compared with the expected frequencies such that all of the totals are the same. By numerous mathematical manipulations a chi-square value is arrived at and compared with a table value for a certain level of significance. If the table value is greater than the computed actual value, then there is no significant difference between the groups, or in this case, Table 3. There is no statistical significant difference between boys and girls in this study. At the .05 level the difference is 1.52 which is less than 3.841, the needed difference at this level. At the .10 level the difference is only 2.708, again less than the computed value.
Table 3. Contingency table: difference between learning and retaining of hour concept of boys and girls

<table>
<thead>
<tr>
<th></th>
<th>Wrong</th>
<th>Right</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys</td>
<td>10.45</td>
<td>29.54</td>
</tr>
<tr>
<td></td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Girls</td>
<td>12.55</td>
<td>35.45</td>
</tr>
<tr>
<td></td>
<td>48</td>
<td></td>
</tr>
<tr>
<td></td>
<td>23.00</td>
<td>65.00</td>
</tr>
<tr>
<td></td>
<td>88</td>
<td></td>
</tr>
</tbody>
</table>

From these findings, then, the author concluded that the second hypothesis was not proven. There was no statistical difference; girls did not learn faster or retain more of their learning than was true of the boys.

Discussion of Findings

The children in this study were very cooperative and enthusiastic when asked to perform tasks with the concept clock. The author had only one child who hesitated to leave his room when asked to come with the researcher. After the second session, however, he joined the author with little protest.

One possible explanation for this enthusiasm was the way in which the material was presented. Because of the author's explanation before asking the questions, most children knew the correct response to make and were able to
feel success in learning the hour concept. Another possible explanation is the
fact that the clock was a new instrument for them, and they were being chal-
lenged by this.

Further discussion is given with the presentation of each training
session.

Responses to: What does the clock tell us?

The author was interested in discovering what meaning or use the clock
had to the pre-school child. They were asked this question: What does the
clock tell us? The responses they gave are listed in Table 4; also, a second
table is given, Table 5, to show the frequency of occurrence of these answers.

It is not surprising to the author to have a number of responses refer-
ring to the clock telling a specific happening in the day, such as time to go to
bed or to school. It appears that many parents first point out the clock as a
means of letting the child know when something will happen, so the child is
taught when the hands of the clock are in this position, it will be time to go to
bed.

Many of the children hesitated and thought before they responded to this
question. Actually, the highest number of responses was, "I don't know"; there were seven respondents with this reply (31 percent). This response
came from more boys (4) than girls (3).

The groups labeled as miscellaneous were very interesting and provided
some insight to the pre-school child's concept of the clock. These answers
are listed in Table 4.
Table 4. Responses made by 22 children used in the study to the question: "What does the clock tell us?"

<table>
<thead>
<tr>
<th>Girls</th>
<th>Answers</th>
</tr>
</thead>
<tbody>
<tr>
<td>BONNIE</td>
<td>that its time to go to bed</td>
</tr>
<tr>
<td>JACQUELINE</td>
<td>I don't know</td>
</tr>
<tr>
<td>DEANNA</td>
<td>when its time to go to bed and when to get up</td>
</tr>
<tr>
<td>JANA</td>
<td>when to eat</td>
</tr>
<tr>
<td>KIRSTEN</td>
<td>lots of things in the day but it stops at night</td>
</tr>
<tr>
<td>KIM</td>
<td>I don't know</td>
</tr>
<tr>
<td>MAUREEN</td>
<td>when to go to bed</td>
</tr>
<tr>
<td>ELESHA</td>
<td>what time it is</td>
</tr>
<tr>
<td>HEATHER</td>
<td>the time</td>
</tr>
<tr>
<td>KRISTEN</td>
<td>I don't know</td>
</tr>
<tr>
<td>JULIE ANN</td>
<td>no answer</td>
</tr>
<tr>
<td>LISA</td>
<td>nothing</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Boys</th>
<th>Answers</th>
</tr>
</thead>
<tbody>
<tr>
<td>THOMAS</td>
<td>when its time to go to bed and when to get up</td>
</tr>
<tr>
<td>MARK V.</td>
<td>I don't know</td>
</tr>
<tr>
<td>DON</td>
<td>the time</td>
</tr>
<tr>
<td>TIM</td>
<td>when to do something</td>
</tr>
</tbody>
</table>
Table 4. Continued

<table>
<thead>
<tr>
<th>Boys</th>
<th>Answers</th>
</tr>
</thead>
<tbody>
<tr>
<td>MARK W.</td>
<td>I don't know</td>
</tr>
<tr>
<td>ERIC M.</td>
<td>when school starts</td>
</tr>
<tr>
<td>KIRK</td>
<td>I don't know</td>
</tr>
<tr>
<td>DARREN</td>
<td>I don't know</td>
</tr>
<tr>
<td>ERIC</td>
<td>a number</td>
</tr>
<tr>
<td>TODD</td>
<td>no answer</td>
</tr>
</tbody>
</table>

Table 5. Frequencies of responses to the question: "What does the clock tell us?"

<table>
<thead>
<tr>
<th>Response</th>
<th>Girls</th>
<th>Boys</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specific happening</td>
<td></td>
<td></td>
</tr>
<tr>
<td>bed time</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>school starts</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>time to eat</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>What time it is</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>A number</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>I don't know</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>No answer</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>
Responses to: Why does a clock have two hands?

It is always fascinating to ask children to explain how things happen or why something is a particular way. Very often their responses are matter-of-factly stated as everyone should know the answer. The most frequent response that was given by these children when asked, "Why does the clock have two hands?", was in relation to pointing to numbers. Five girls and three boys gave answers that referred to the hands of the clock as being used to point to numbers. Some answers, although referring to numbers, gave an interesting addition. One girl responded, "So if one hand misses the number the second one can pick it up." Another interesting comment made by one boy referring to the use of the hands in relation to numbers was, "Because one has to stay at the top and one moves around the numbers."

Two children, both female, stated the hands were used to tell time. One child had some misconception in her answer, "One tells us time; I don't know what the other one does." The other subject stated matter-of-factly, "Because if it didn't have any hands it couldn't tell time." One male stated, "If it had three hands it would be ruined."

Two children showed part awareness of the use of the clock hands with their statements, "One goes fast and one goes slow," and "One is short and one is bigger."

Some interesting answers given but ones than did not show any real awareness of the use of the clock hands were, "For one to go underneath," One's a girl and one's a boy," and "God made it that way."
The author received five responses of "I don't know," two girls and three boys. Only one child would give no answer at all, a female who just looked at the clock but gave no verbal responses.

The responses to this question varied a great deal and pointed out the individual differences of these subjects. All of the responses to this question are listed in Table 6.

Responses to Procedure 1

The author found that most children were interested in the clock and when invited to move the hands and trace them, only two children needed further encouragement than by just verbal suggestion. With these two children the author first moved the clock's hands and then took the child's hand in hers and moved the clock hands with them.

Figure 1 indicates the various responses from the children when asked, "What do you see, when looking at the clock?"

The most common response made by the children was in reference to the hands on the clock. The author received seventy-five answers that mentioned in some aspect the hands on the clock. Twenty-one children said the clock had hands, fifteen were aware that the hands could move, and nineteen expressed the knowledge that the hands were different in size. It is interesting to note that of the ten children that mentioned the different colors of the hands, eight were females and only two were males. Kagan and Lemkin (1961), in their study, found that boys were more likely to use color as a basis for conceptualization than were girls; however, in this study more girls mentioned the color difference of clock hands than was true of boys.
Table 6. Responses made by the 22 children used in the study to the question: "Why does the clock have two hands?"

<table>
<thead>
<tr>
<th>Girls</th>
<th>Answers</th>
</tr>
</thead>
<tbody>
<tr>
<td>BONNIE</td>
<td>one goes fast and one goes slow</td>
</tr>
<tr>
<td>JACQUELINE</td>
<td>I don't know</td>
</tr>
<tr>
<td>DEANNA</td>
<td>for one to go underneath</td>
</tr>
<tr>
<td>JANA</td>
<td>to point at numbers</td>
</tr>
<tr>
<td>KIRSTEN</td>
<td>so if one hand misses the number the second one can pick it up</td>
</tr>
<tr>
<td>KIM</td>
<td>to tell us the numbers</td>
</tr>
<tr>
<td>MAUREEN</td>
<td>to point at the numbers</td>
</tr>
<tr>
<td>ELESHA</td>
<td>for us to be able to read the numbers</td>
</tr>
<tr>
<td>HEATHER</td>
<td>one tells us the time, I don't know what the other one does</td>
</tr>
<tr>
<td>KRISTEN</td>
<td>I don't know</td>
</tr>
<tr>
<td>JULIE ANN</td>
<td>no answer</td>
</tr>
<tr>
<td>LISA</td>
<td>because if it didn't have any hands it couldn't tell time</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Boys</th>
<th>Answers</th>
</tr>
</thead>
<tbody>
<tr>
<td>THOMAS</td>
<td>one is short and one is bigger</td>
</tr>
<tr>
<td>MARK V.</td>
<td>I don't know</td>
</tr>
<tr>
<td>DON</td>
<td>if it had three hands it would be ruined</td>
</tr>
</tbody>
</table>
Table 6. Continued

<table>
<thead>
<tr>
<th>Boys</th>
<th>Answers</th>
</tr>
</thead>
<tbody>
<tr>
<td>TIM</td>
<td>one's a girl and one's a boy</td>
</tr>
<tr>
<td>MARK W.</td>
<td>for the numbers</td>
</tr>
<tr>
<td>ERIC M.</td>
<td>because one has to stay at the top and one moves around the numbers</td>
</tr>
<tr>
<td>KIRK</td>
<td>I don't know</td>
</tr>
<tr>
<td>DARREN</td>
<td>God made it that way</td>
</tr>
<tr>
<td>ERIC</td>
<td>to point at the numbers</td>
</tr>
<tr>
<td>TODD</td>
<td>I don't know</td>
</tr>
</tbody>
</table>
Figure 1. Comparison of frequencies of answers of question, "What do you see?", when looking at the clock.
The author received three responses of, "I don't know." After further encouragement from the author, two subjects went on to describe the clock. Only one child, a female, would give no response at all.

Two children, both boys, gave an incorrect response to the color of the hand; one said green and the other gave yellow. Two children, one female and one male, responded with "I don't know." When asked if the red hand was longer or shorter, two boys and one girl responded with longer. The author moved the two hands together and asked, "Which one is longer now?" Two children said the blue one. One boy still said the red one. Two children responded with "I don't know."

All the subjects correctly responded to pointing to the short, red hand; however, four subjects were incorrect on the number that the hand was pointing to (four). The author corrected these subjects' responses. When asked what the hour was, six children responded with the wrong hour; four of these, three females, one male, told the author it was twelve o'clock. One male said it was nine o'clock. The author repeated the first steps and all the subjects corrected their response except one male who said, "I don't know."

Responses to Procedure 2

The author began this session with first encouraging the recognition and identification of the parts of the clock as a review from procedure 1. One subject enthusiastically responded with, "Oh, I remember all about this clock."

Then the subject told the author all the parts of the clock she could remember.
One child was not as enthusiastic with his response, "Oh, not this again, I have already done it." Most children responded by naming even more parts of the clock than were given in the first session.

The questions and responses for procedure 2 are listed in Figure 2.

More correct responses were received from girls than boys for each question asked. However, this chart is somewhat misleading when taking into consideration the fact that this study involved twelve girls and only ten boys. In some of the questions, that is the number of differences in correct responses.

There were two children who were incorrect in counting the numbers, one female and one male. The author was aware of the male's extreme nervousness during this entire session. He was incorrect in all responses given. At the end of the session the author talked with the subject for a long time. The subject seemed to be more relaxed with the author in the future sessions.

The concept that appeared to be the hardest for the children to understand and perform was that of moving the hand in a clockwise direction. Five boys and three girls were incorrect in their response when asked to move the hand around the clock. In the rest of the answers to the questions asked, there were no more than four incorrect responses given.
Counting the numbers

Pointing to the short, red hand

Moving the hand to number 4

Moving the hand around the clock in a clockwise direction

Showing the hand that tells the hour

Telling the time that the clock said
SUMMARY AND CONCLUSIONS

The purpose of this study was to investigate the influence of a training experience on the pre-school child's ability to learn the time concept of the hour.

Twenty-two children were involved in this exploratory study. The subjects were attending the Child Development Laboratories at Utah State University. These children were given a pre-test to evaluate their present knowledge of the hour concept. They then received three training sessions with the author in instruction of the time concept of the hour.

The children were trained and tested individually by the author in the Child Development Library, adjacent to one of the Child Development laboratories.

The children did score significantly higher on the post-test than the pre-test; however, the findings revealed no significant difference between the scores of the boys and girls in the learning or retaining ability of the hour concept.

From this study it may be concluded that children who receive a given amount of instruction will be able to recognize the hour concept of a clock when leaving the large hand always constant on the numeral twelve. The sex of the child is not a significant factor in learning the hour concept of the clock.
RECOMMENDATIONS FOR FUTURE STUDIES

1. Because of the general lack of studies in this area, more studies are needed in the understanding of time concept development in young children.

2. A study to learn how the environment of the home and community influence children's concepts of the use of time.

3. A further study employing the same learning instruments, in which the investigator would be able to learn the child's concept of how long an hour is.

4. Another study using a larger sample with an experimental and a control group to study both sex and age differences.
LITERATURE CITED


Brownell, William A. 1945. This is arithmetic. Association for Childhood Education, Washington, D. C.


Appendix A

Data Sheet
Data Sheet

<table>
<thead>
<tr>
<th>Child's Name</th>
<th>Sex</th>
<th>Age</th>
<th>Test Date</th>
</tr>
</thead>
</table>

Procedure 1 (this was originally recorded with a tape recorder and then transferred to the sheet)

What do you see? Allow time to look and encourage feeling the clock

What does the clock tell us?

Why does the clock have two hands?

What color are the hands of the clock?

Which hand is shortest?

Procedure 2

<table>
<thead>
<tr>
<th>Activity</th>
<th>Correct</th>
<th>Incorrect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Counting numbers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moving the short, red hand</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clockwise movement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>What is the hour</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moving the hand</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Showing the hour hand</td>
<td></td>
<td></td>
</tr>
<tr>
<td>What time does it say</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Procedure 3

The session was used for a review in which the concepts introduced in the first two sessions were reinforced.
Figure 3. Number of hours answered correctly on the Pre-test as compared to Post-test 1 and Post-test 2 for girls and boys. Hours asked: 1 o'clock, 5 o'clock, 8 o'clock and 11 o'clock.
VITA
Faye Blair Daines Campbell
Candidate for the Degree of
Master of Science

Thesis: Hour Concept Learning in Pre-School Children

Major Field: Child Development

Biographical Information:


Education: Attended elementary school in Logan, Utah; graduated from Logan Senior High School in 1966; graduated from Dixie Jr. College, St. George, Utah, with an Associate of Science degree, in 1968; attended Merrill-Palmer Institute during the summer of 1969; received the Bachelor of Science degree from Utah State University, Logan, Utah, in June, 1970; completed requirements for the Master of Science degree, specializing in child development, at Utah State University in 1971.

Professional Experience: Fall, 1971, and school year, 1970-71, head teacher at Utah State University Child Development Laboratory; summer, 1971, director of summer play program for Conference and Institute Division at Utah State University.