

AN INVESTIGATION OF THE NATURE AND
DEVELOPMENT OF TIME CONCEPTS IN ELEMENTARY
SCHOOL CHILDREN

Thesis for the Degree of Ph. D.
MICHIGAN STATE UNIVERSITY
FE GADDI ANSELMO

1967

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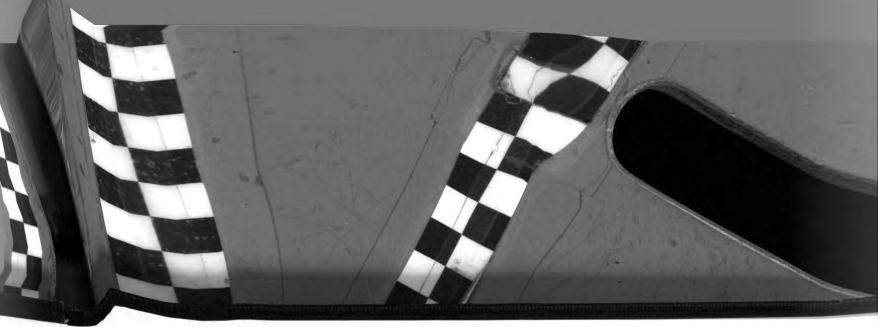
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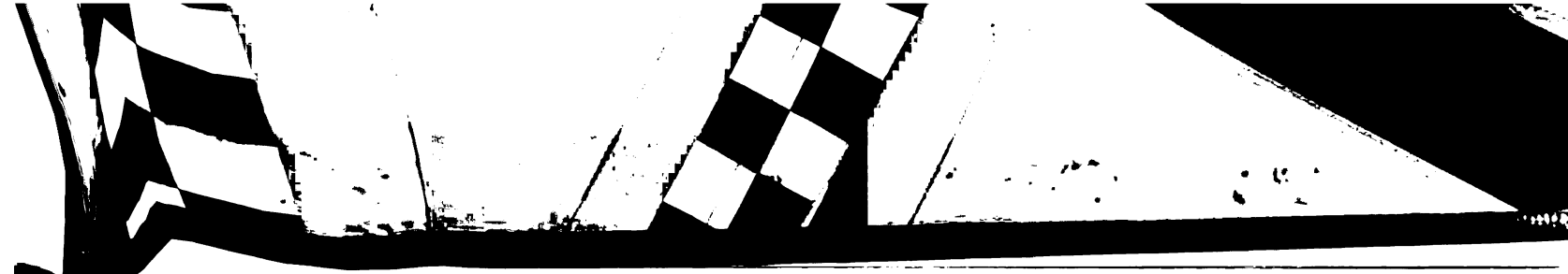
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ABSTRACT

An Investigation on the Nature and Development of Time Concepts in Elementary School Children

By Fe Gaddi Anselmo

This study was, first of all, an attempt to present a qualitative and quantitative description of the nature and development of time concepts in children. Its major objective was to determine the relationship between time concepts and intelligence, mental age, and chronological age. Also, the study aimed to determine any significant differences between the groups on the Time Concept Test, when divided according to sex, grade placement, and socio-economic status. Specifically, the study attempted to test the following hypotheses:

1. There is a gradual and steady growth in the formation of concepts of time in children with age.
2. There is a positive relationship between children's concepts of time and intelligence.
3. There is a positive relationship between children's concepts of time and mental age.
4. Time concepts of children are more closely related to intelligence and mental age than to chronological age.
5. There is a significant difference in the time con-

cepts of pupils from grades two through six.

6. There is no significant difference between the sexes in their concepts of time.
7. There is a significant difference in the time concepts of pupils from varying socio-economic levels.

The sample for the study was composed of 135 boys and 113 girls, or a total of 248 pupils from grades two through six. The chronological ages of the subjects ranged from 7-0 to 12-0; mental ages ranged from 6-7 to 16-10; and intelligence quotients ranged from 70 to 150.

Data on chronological age, sex, grade placement, and socio-economic status were collected for all the subjects, and the Time Concept Test together with the Otis Quick-Scoring Mental Ability Tests were accordingly administered to gather data on intelligence quotient and mental age.

Correlation coefficients for the Otis IQ and MA scores and chronological ages on the Time Concept Test scores were computed to determine the relationship of time concepts to intelligence quotient, mental age, and chronological age. Analysis of variance of the grade levels, the sexes, and the various socio-economic groups were made on the Time Concept Test scores to determine any significant differences between the groups.

Analysis of results revealed the following:

1. The data supported the hypothesis that there is a gradual and steady growth in the formation of con-

cepts of time with age.

2. The hypothesis that a positive relationship between Time Concept Test scores and intelligence quotient would be found was sustained.
3. The hypothesis that there is a positive relationship between Time Concept Test scores and mental age was also statistically supported.
4. It was hypothesized that time concepts of children are more closely related to intelligence quotient and mental age than to chronological age. Results indicated that time concepts are more highly related to mental age than to chronological age, but did not show that time concepts are more highly related to intelligence quotient than to chronological age.
5. The data showed that there is a significant difference in the performance of the pupils in grades two through six on the Time Concept Test.
6. The data also indicated that there is a significant difference between the boys and the girls on their performance on the Time Concept Test, in favor of the boys.
7. Results did not show that there is a significant difference in the performances of pupils from varying socio-economic levels - the professional, semi-professional, skilled, and semi-skilled groups on the Time Concept Test.

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DEVELOPMENT OF TIME CONCEPTS IN
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By
Fe Gaddi Anselmo

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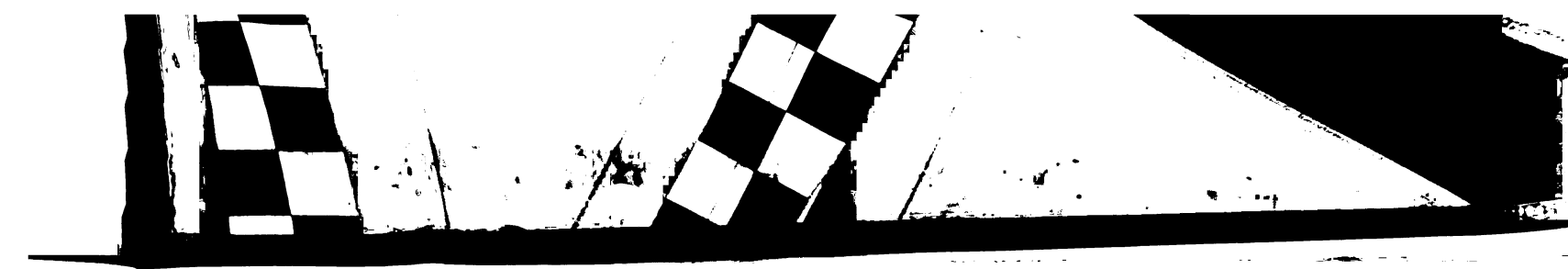
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CHAPTER I

THE NATURE OF THE PROBLEM

There are numerous references that deal with the study of concept formation. Various types of concept formation in children such as concepts of form and color, space and distance, position, size and magnitude, number, physical causality, animistic, and personal-social, have been investigated. Studies have also investigated the relationship of concept formation to such factors as mental age and intelligence, chronological age, sex, training and experience, grade placement, and socio-economic status. However, very few investigations seem to have been conducted on the nature and development of the sense of time in young children.

The concept of time is one of the many abstract concepts that a child in a time-regulated society must learn, if he would adjust himself satisfactorily in such a society. As soon as an infant is born into this society, his daily routine activities are fitted into a time schedule to which he must gradually learn to adjust. As the infant grows older, he is faced with many more demands relating to time schedules as in his search for nourishment, his rest and play activities, and all of his other routines. It may be seen from this example that the growing child is continuously being faced with rules about time which must be solved

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in a way the will satisfy his needs, and by behavior that will not be in serious conflict with the needs of other individuals in his social environment. Slowly the child begins to get an idea of the measurement of time. With the broadening of his experiences with adults, the child also keeps on adding to his vocabulary time expressions which adults use, but for most of which he may not have correct and complete understanding because of the highly abstract nature of time concepts. It should be pointed out here, that accurate concepts of time are needed in almost any society where people have to deal with people. Imagine the confusion that could result, for example, if people did not have a common gauge with which to measure time.

An examination of the social studies program in the elementary grade reveals that the content of the social studies revolve around units which almost always involve concepts of time. As early as the kindergarten level where the emphasis in the social studies centers around the family and the school, most units or projects involve an understanding of vacations, holidays, special events, and celebration of birthdays which are all based upon concepts of time. Although there is great diversity in the content of the social studies in grades four through six, a great number of schools include in their curricula a study of peoples and countries around the world, and also of historical events. To develop better understanding of these topics and events,

a grasp of concepts of time is of great importance.

A review of the literature about concepts of time points heavily to the emphasis in many studies on the compilation and the usage of the verbal expressions of time in the young child. Maturation and training as important factors in the acquisition of concepts of time, knowledge about the appearance of the clock, and estimation of time durations and intervals have also been dealt with in the literature to a limited extent. Attention has been paid to the relationship between concepts of time and intelligence. It appears, however, that there have been few objective and reliable methods of measuring children's concepts of time. Most of the tests used to measure time concepts in children are not as objective as they could be, and generally no information is given regarding reliability or validity. In many studies, testing of children's comprehension of time was done by interviews. In investigations where written tests were used, reliability and validity of the measuring instruments seem not to have been considered seriously, if at all.

Thus, it seems apparent that investigations of the development of concepts of time and the relationship of time concepts to intelligence and other factors such as sex, chronological age, grade placement, and socio-economic status have not been as free of deficiencies in method and technique as they could be, nor has adequate information

been supplied by the investigators regarding the quality of their measures. Furthermore, the important question of how understanding of time concepts develop with increasing age in children is one that seems in need of further study.

In view of these considerations it seems desirable to carry out a study of the development of time concepts in children and the relationship of these concepts to other maturational and developmental factors which will remedy some of the shortcomings of available studies, and perhaps add to our understanding of this important aspect of child development.

Statement of the Problem

The purposes of the present study are to investigate the nature and development of time concepts in elementary school children, and to determine the relationship of these concepts to intelligence, mental age, and chronological age. Also, the study aims to determine any significant differences between the groups on their time concepts, when these groups are divided according to sex, grade placement, and socio-economic status. The study is first of all, an attempt to present a qualitative and quantitative description of the nature and development of time concepts in children. Its significance lies in the possible applicability of the conclusions to classroom methods.

After a review of the literature and a survey of the time expressions being used by children of various age lev-

els, a "Time Concept Test" was constructed. The test was then administered to a small sample of children from grades two through six. After the test was tried and scored, an item analysis was done and the test was revised. Then a larger sample was chosen and the Time Concept Test in its revised form was administered. The Otis Quick-Scoring Mental Ability Test Alpha Short Form and Beta Form CM were also administered to obtain measures of the children's intelligence quotients and mental ages. Also, data on chronological age, sex, grade placement and socio-economic status were collected for all the subjects. Correlation between Time Concept Test scores and the Otis IQ and MA scores, and chronological age were computed to determine the relationship of time concepts to intelligence, mental age, and chronological age. Analysis of variance of sex, grade placement, and socio-economic status on the Time Concept Test scores yielded F values from which significance levels for each of the three factors were determined. A complete procedure and methodology will be presented in Chapter III.

The study differs from investigations reviewed in Chapter II in several respects deemed to be of some importance. The Time Concept Test used has been constructed according to accepted principles of planning, constructing, and evaluating such instruments as will be described in detail in Chapter III. The Otis Quick-Scoring Mental Ability Test which is one of the well-constructed and widely used group intelligence tests was used in this study. It is believed

that through the use of such measuring instruments the results of the study become more reliable and conclusive.

Based on the previous discussion, the following hypotheses are offered to be tested in this study:

Hypothesis I. There is a gradual and steady growth in the formation of concepts of time in children with age. Because children's experiences are continuously and progressively expanding with the increase in age, it is believed that pupils keep on acquiring concepts of time as they grow into maturity.

Hypothesis II. There is a positive relationship between children's concepts of time and intelligence. It is felt that intellectual ability is reflected by the concepts of time the children have; therefore, it is expected that the data will show a positive relationship between concepts of time and intelligence quotient.

Hypothesis III. There is a positive relationship between children's concepts of time and mental age. It is also expected that mental age will show a positive relationship with concepts of time, because mental age indicates level of maturity.

Hypothesis IV. Time concepts of children are more closely related to intelligence quotient and mental age than to chronological age. Mental age indicates level of maturity, and it is believed that maturation is a significant factor in the development of time concepts. Also, IQ furnishes the degree of brightness, and it seems that brightness is re-

flected in dealing with the concepts of time. Therefore, when compared to chronological age as such, it is expected that IQ and MA will have better predictive values in the development of the concepts of time.

Hypothesis V. There is a significant difference in the time concepts of pupils in grades two through six. Since every grade level indicate an increase in age and an accumulation of direct and vicarious experiences, it is expected that there will be increased skill in pupils' performance on the Time Concept Test with each succeeding grade.

Hypothesis VI. There is no significant difference between the sexes in their concepts of time. Taking all things equal, it is believed that sex as a factor will not influence the pupils' performance on the Time Concept Test.

Hypothesis VII. There is a significant difference in the time concepts of pupils from varying socio-economic levels. Because family background and interests modify experiences, it is anticipated that the socio-economic level of the child will determine in part his performance on the Time Concept Test.

Definitions

Concept and the process of concept formation. Considerable attention has been given to arrive at a definition of a concept and of the process by which concept formation develops. The literature reveals a lack of complete agreement;

many however, agree on central points.

Wann, et al., (28), after a survey of the work done in the area of concept formation defined concepts as " a generalized idea or understanding embodying many images and memories which have been blended into a meaningful whole."

Welch (30), reviewed the literature on the growth of abstract concepts in children and concluded that the principal variables in determining the development of abstract thinking are: discrimination, generalization, and memory.

Three main types of concept formation are described by Leeper (16). He names the first type as inductive, which involves the process of discrimination, abstraction, and generalization. He names the second type as deductive, which he believes is a very common type of thinking whereby hypotheses are used. He calls the third type as inventive concept formation, which he associates with creative thinking.

McDonald (17), defines concept as " a classification or systematic organization of stimuli, characteristics, or events which have common characteristics. Two processes are involved in learning a concept: first, the child makes discriminations by which he distinguishes one concept from another; second, he generalizes the concept to other examples of it."

To illustrate the acquisition of a concept according to McDonald's definition: if a teacher wants a child to learn the concept of a clock, mere repetition of the definition of

a clock is not enough. A much more complicated process is involved whereby the child must be able to distinguish what a clock is. He must be able to distinguish a clock from other geometric forms and from other instruments and devices being used for telling time (discrimination). Also, the child must be able to utilize the description of a clock to identify many examples of clocks (generalization).

Time concepts. In this study, time concepts include the general divisions of time such as minutes, hours, days, weeks, months, years, centuries; the seasons of the year; holidays; indefinite time expressions such as today, May 7, 1966, 400 B.C.; the past, the present, and the future; telling age; and telling time by the clock.

Intelligence. According to Wechsler (29), "intelligence is the aggregate or global capacity of the individual to act purposely, to think rationally, and to deal effectively with his environment". Insofar as this capacity is measured by the Otis Quick-Scoring Mental Ability Tests, Alpha and Beta forms, the definition is acceptable for the purposes of this study. It is believed by the present investigator, that what the Otis measures conforms quite closely to this definition.

Need for the Study

The acceptance of the importance to tell time accurately in a time-regulated society and the preceding dis-

cussion has pointed up the need for research on the concepts of time in elementary school children.

The importance of knowing what children at various age levels comprehend about time so adults can adjust their language usage of the different time expressions has accentuated this need.

The fact that children can get more sense of historical sequence, if they have developed proper concepts of time make the need for the study apparent.

There has been moderate amount of basic research on the nature and development of time concepts in elementary school children and even smaller amount about the relationship of time concepts to intelligence and certain other factors. The failure of the earlier studies to report any information about the quality of their "Time Concepts Tests" and the failure in most instances to give necessary information about the various other measures used, also points to the need for this study.

Limitations of the Study

Data about children's chronological age, sex, grade, and father's occupations were all taken from the school records and from the data sheets filled out by the pupils with the help of their respective classroom teachers. It was assumed that the father's occupation is the most valuable single index of the socio-economic status of the family. So, what was done was to classify the father's occupation ac-

According to the Socio-Economic Scale by Kefauver, Noll, and Drake (12). It is known that in order to make accurate and valid classifications of occupations, certain facts about the occupation must be ascertained. In this study, the classification was based on the occupation per se and the amount of education the father was reported to have had in the school records.

CHAPTER II
REVIEW OF RELATED RESEARCH

A. Concept Formation In General

Concept formation has always been of great interest to psychologists, educators, students of human development, and others concerned with the learning process in children. Investigations of various kinds of concept formation under different conditions have been reported in the literature. Since this study is primarily concerned with determining the nature and development of time concepts in elementary school children, only two types of studies of concept formation in general will be reviewed here. First, will be studies of the nature of concepts and the process by which concepts are formed. Second to be reviewed are studies of the relationship of concept formation to such factors as intelligence and chronological age.

Since the major purpose of the study to be reported here was to investigate a particular type of concept formation, namely that of time in younger children, all the studies that were found in the published literature related to this specific problem are reviewed here. These reviews constitute the greater portion of this chapter.

An article by Vinacke (26), about concept formation in

school children discusses the properties of concepts, and characterizes the period from six to fifteen or sixteen years of age, as the period during which conceptual development occurs at the most rapid pace. As suggested by researches with children, Vinacke arrives at the following principles of concept formation:

1. Increasing age (significant accumulation of experience) is the single most important variable in concept formation.
2. Progress in learning concepts is a continuous and cumulative affair, rather than occurring in distinct phases.
3. Earlier concept learning provides a preparation for later development.
4. Among the most important specific changes which take place with increasing age, are the following:
 - a. progression from simple to complex concepts
 - b. progression from diffuse to differentiated concepts
 - c. progression from egocentric to more objective concepts
 - d. progression from concrete to abstract concepts
 - e. progression from variable to more stable concepts
 - f. progression from inconsistent to more consistent and accurate concepts
5. Concept formation involves processes which cannot be inferred from either age or vocabulary.

Welch (30), carried on an investigation to discover when children normally begin to learn abstract concepts. Specifically, the study was aimed at ascertaining the rate at which children's vocabulary of abstract concepts normally increases, and at determining how much training is necessary in order to teach children from three to six years of age, abstract concepts of the "first", "second", and "third" order. Welch, in the same study, also made an analysis of the general development of the hierarchial structures of concepts.

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1. Increasing age (although accumulation of experience) is the single most important variable in concept formation.
2. Progress in learning concepts is a continuous and cumulative effort, rather than occurring in distinct phases.
3. Earlier concept learning provides a preparation for later development.
4. Among the most important specific changes which take place with increasing age, are the following:
 - a. progression from simple to complex concepts
 - b. progression from ill-defined to differentiated concepts
 - c. progression from specific to more objective concepts
 - d. progression from concrete to abstract concepts
 - e. progression from variable to more stable concepts
 - f. progression from inconsistent to more consistent and accurate concepts
5. Concept formation involves processes which cannot be limited to either age or vocabulary.

Weich (19), carried on an investigation to discover when children normally learn to learn abstract concepts. Basically, the study was aimed at ascertaining the rate at which children's acquisition of abstract concepts normally increases, and ascertaining how much training is necessary in order to teach children from three to six years of age, abstract concepts of the "first", "second", and "third" order. Weich, in the same study, also made an analysis of the general development of the hierarchical structures of concepts.

He used two different types of tests. The first one was an "identification and "questionnaire" test which he gave to ninety-three children from twenty-one to seventy-two months of age. Welch's procedure for the identification test illustrates very well the problem of concept analysis confronting the child. His material and method of testing are described in the following paragraph.

The materials for the identification test were a toy dog, a cow, a horse, and a pig, a soldier and a nurse, a hat, coat and shoes, a chair and table, a carrot, a potato, an apple, a banana, and an orange. The smaller materials were spread on a table. The child was asked to identify at least two animals, the man and woman, two vegetables, two fruits, and the two pieces of furniture when these species names were given. After that he was asked to place the "animals" over in one corner of the table and then all the "vegetables". The toys were then mixed up and he was asked to put the "people" over in another corner of the table and to give them "fruits". He was also asked what "furniture" he liked best and to show the experimenter his "clothes". He was asked to pick up the "soldier" and the "nurse" and to collect all of the "food" in his lap. If the child manifested knowledge of the animals, people, clothes, furniture, and food concepts in relation to their respective species, he was given credit for understanding five first degree order abstract concepts. If, in addition, he properly identified the fruits and vegetables, the soldier and the nurse, he was given credit for a knowledge of the second hierarchy concepts. The total number of points for this test was eight.

Examples of questions taken from the questionnaire are the following:

1. Have you any animals or pets at home? (The child was credited with one point if he mentioned the name of any breed).
2. What games do you like to play? (one point)

The identification and questionnaire tests were given in conversational form which required about fifteen to twenty minutes. Test results show a sharp increase in the know-

ledge of the abstract concepts with the increase in age.

The second test was the "general conditioning" test or "block conditioning" test.

In the general conditioning test eight unpainted wooden blocks of approximately the same size were used. Each was given an alphabetic name. In order to establish first hierarchy concepts, the blocks were collected into four groups of two each and in turn, these groups were included in two more inclusive ones, which constituted second hierarchy concepts. The third hierarchy concepts involved the class which represented all of the blocks.

The "block conditioning" tests were given to a total of sixty-four subjects: fifty children from thirty-six to seventy-two months of age, and two mentally defective teenagers - one fourteen, and the other eighteen years of age. Test results show a gradual improvement in learning between the ages thirty-six to fifty-seven months of age and a spurt in learning around the sixth year level.

In order to prove his hypothesis that concept formation ability is more highly related to mental age than to chronological age, Coleman (4), administered "a concept formation task of the categorizing type" and the Wechsler Intelligence Scale for Children, to fifty children each, at ages seven, nine, and eleven. Four conceptualization scores: (a) number of concepts, (b) mean time per concept, (c) degree of dimensionality, and (d) number of non-functional concepts were correlated with mental age and chronological age. The results indicated that three of the four variables, namely, the number of concepts achieved, the mean time necessary to produce a concept, and the number of non-func-

tional concepts are all related to mental age. Only two of the four variables - number of concepts achieved, and the mean time necessary to produce a concept are related to chronological age. Based on the obtained results, that is - consistently higher values of coefficient of contingency found for mental age than for chronological age and the four conceptualization scores, Coleman concluded that mental age is a better predictor of categorizing ability than chronological age.

B. Studies of the Development of Time Concepts

1. Time Expressions

Considerable interest has been shown concerning the time expressions being used and understood by children at different age levels.

In a study by Ames (1), observations were made of the spontaneous verbalization of time concepts by children who ranged in age from eighteen to forty-eight months. These children and others up to eight years of age were interviewed and were asked a series of questions about time. In both the observations and the interviews, a developmental trend was noted: words indicating the present were first used, then words about the future, and lastly words about the past. It was also found that mastery of a time concept appears in stages. Responses to a time word is first manifested by waiting, then by using the word spontaneously, and finally by answering correctly questions about the concept.

At about four years of age, the child knows whether it is morning or afternoon; then what day it is, at five years; then what time it is, at seven years. Between the age of seven years and eight years, the child can tell what month it is, what season, what year, and what day of the month it is. Most children know their age by three years, their next birthday by four years, and how old they will be on their next birthday, by five years of age. Ames also concluded that time concepts tend to develop from the specific to the general.

Further light on the time expressions comprehended by children of the elementary schools is afforded by Kelty's (13, 14), study. One hundred books were selected from several lists of primary grade readers. Each book was carefully examined word by word, and the time expressions encountered in the books were recorded under three classifications: "indefinite", "definite", and "comparative". A tabulation was made as to the frequency of use of each time expression, and these words became the basis for constructing the test used in a later study.

The test was given to fourth, fifth, and sixth grade pupils. It consisted of five parts, with specific purposes for each part. Test I was primarily a reading test wherein the children read a paragraph and they had to look for time expressions that told when the story happened. Test II was designed to test understanding of chronology as shown in the following example: "Below are the names of the Seasons.

Spring is numbered 1. Put the number 2 before the season that comes next and so on. 1 Spring, ____ Autumn, ____ Winter, ____ Summer." Test III tested time judgments in a given context. Actually it was a matching type test wherein the children chose the correct answer from a list of words to fill in the blanks in the sentence. For example: "Seven days make a ____." 2. A score of years is ____ years." Test IV was in the form of analogies such as "Monday : Tuesday : Friday : (Thursday, day, Saturday, week)." Test V was designed to find out whether children preferred definite or indefinite time expressions in placing stories in time. For example, the children were asked to check the one situation they like best:

1. I like stories that took place
 ____ in the thirteenth century
 ____ long, long ago

Test results show that the ability to select time expressions that told when a story happened increases fairly steadily from grade to grade. The test results also showed that as children progress from grade to grade, there was an increasing preference for definite time expressions.

A broader investigation designed to appraise the ability of children to understand and interpret their physical and social environment, was conducted by Wann, Dorn, and Liddle (28). Children ranging in age from three to five years who were enrolled in five schools of various socio-economic levels were studied. (Only part of the study that deals with the concepts of time is being reported here.) It

was noted through numerous recordings, that attempts were made by children "to straighten out and use the convenient designations of time" such as hour, day, week, year, yesterday, and ~~tomorrow~~, but not the term month. It was also noted that children were very much interested in objects and events remote in time; in the changes caused by the passage of time; and things that were "old fashioned". The researchers saw nothing in the study that indicated that children at the ages studied were developing a chronological sense of time. The evidence supported the idea that much of the learning in children is episodic rather than logical. In other words, they say, children learn more from episodes or incidents that occur in their everyday experiences than from the logical organization of learning experiences.

Using time expressions as content, Buck (3), constructed a test, which he claims to be an "emergency test". He stated that "emergency tests" are used:

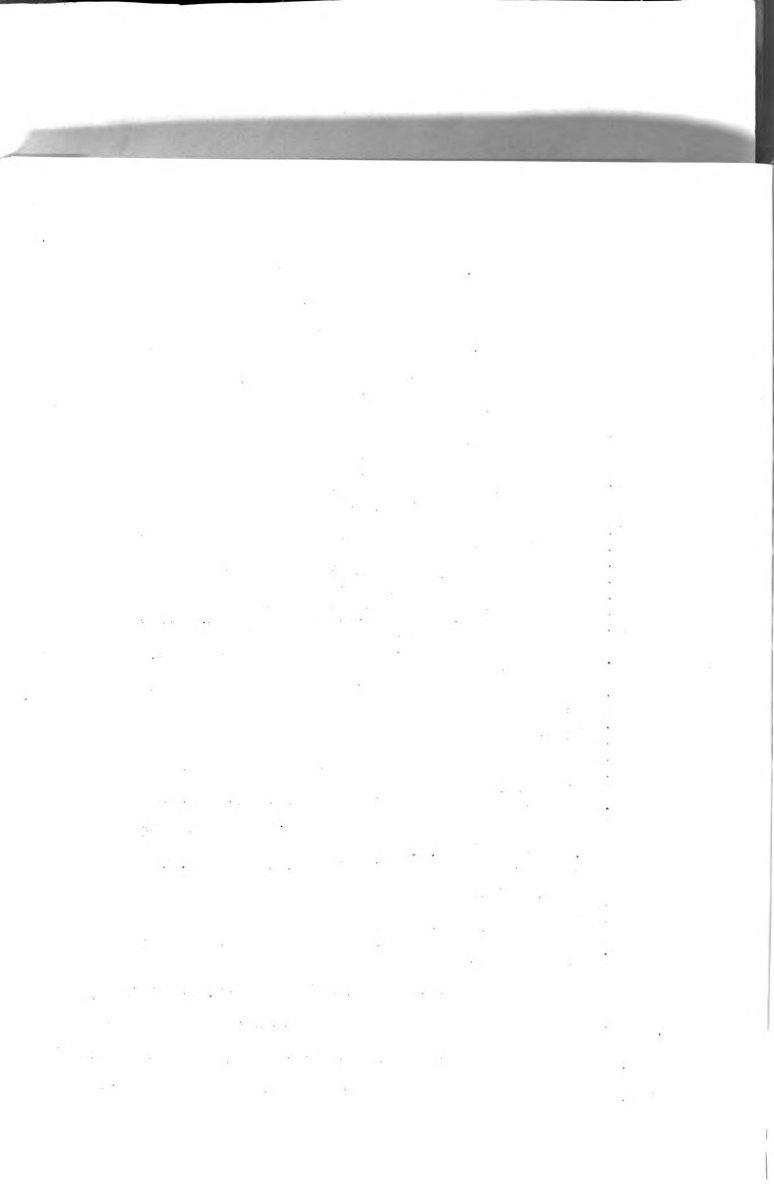
to provide the psychiatrist with a psychometric tool that he can employ when no qualified psychological assistance is available; wherever and whenever "time is of the essence" so to speak, the emergency test has a definite place. In the clinic, and in the mental hospital it may be used as an initial screening device and to help determine what further psychometric procedure may be indicated; it may also be used at regular intervals as a follow-up check upon the patient's progress. In personal work, it may be employed by the interviewer as an aid in making a rough appraisal of the applicant's qualifications for a given position; also to check upon the veracity of the applicant's statements concerning his educational attainments.

Buck's test contained thirty questions. It was given as a group test to 675 white persons ranging in age from eight

to twenty-three years, and a range in educational status from third grade to third year college. Below are the items of the test:

1. Is it morning or afternoon now?
2. About what time is it by the clock now?
3. What day of the week is it?
4. What month is it?
5. What day of the month is it?
6. What year is it?
7. What season of the year is it?
8. How many days are there in a week?
9. How many minutes are there in an hour?
10. How many hours are there in a day?
11. How many days are there in a month?
12. How many months are there in a year?
13. How many seasons are there in a year?
14. How many seconds are there in a minute?
15. How many months are there in a season?
16. How many seconds are there in an hour?
17. In what month is Thanksgiving Day? On what day in that month does it always come?
18. In what month is Christmas? On what day in that month does it always come?
19. In what month is Hallowe'en? On what day in that month does it always come?
20. What is a decade?
21. What is a century?
22. What is a fortnight?
23. What does anyone mean when he says "Nine A.M." and "Nine P.M."?
24. What words do these initials "A.M." and "P.M." stand for?
25. What does anyone mean when he says "The year 450 B.C." and "450 A.D."?
26. What words do these initials "B.C." and "A.D." stand for?
27. What is a time zone?
28. Name the time zones in the United States.
29. What is a Greenwich mean time?
30. What does anyone mean when he says "Vernal Equinox" and "Autumnal Equinox"?

Buck set no time limit for taking the test. He claims that his test correlates with the Stanford-Binet Intelligence test, but he does not give a numerical value of the correlation. He points out "economy of time" as one of the good fea-



tures of the test, instead of a weakness that could be greatly improved. Later, the test forms were amended when it was administered as an individual test to 350 white persons, ranging in age from seven to seventy-five years, and an educational status of from no schooling to eight years college.

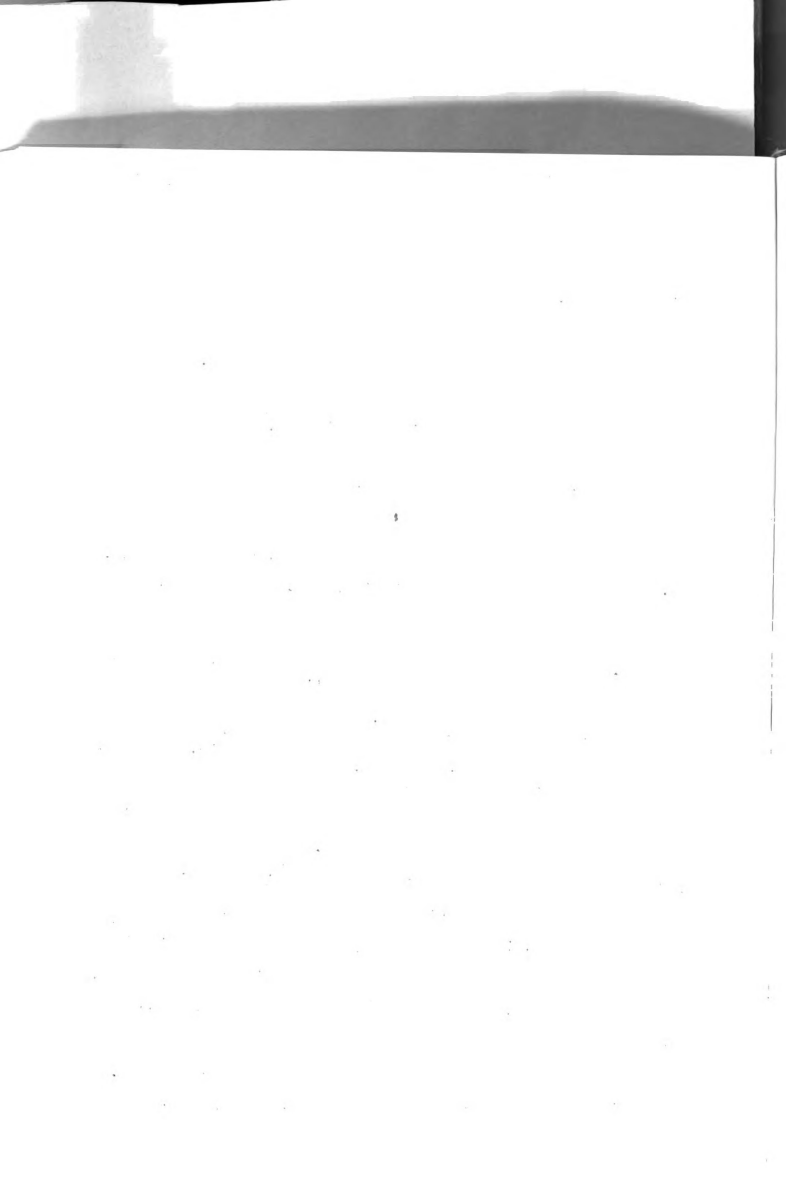
A study that gives the historical and philosophical background, as well as experimental evidence about time concepts was done by Sturt (24). The study involved British children from four years to thirteen years of age. Eight types of tests were used: questions test, order of dates test, temporal absurdities, temporal completion, pictorial identification, temporal order of historical characters, temporal memory, and making an appointment test. In the questions test, easier questions were used for younger children, such as "What is your age?" For older children, the hardest questions were about time duration, such as "How long would it take you to walk around this room?" The questions test showed that children very seldom used dates. In the "order of dates" test, the children were given names of people which they were to arrange in the order in which those people lived. In the temporal absurdities test which dealt with Julius Caesar, most of the children discovered absurdities about gunfire, but missed the statement that 58 B.C. was three years after 55 B.C. The "temporal completion" test was used to investigate children's knowledge of the differences between different time epochs. The children were given sentences to complete which dealt with the dress

and social life of the Romans and of the English in the time of Charles I. Examples of the sentences to be complete were as follows: "The occupations of the English in the time of Charles I were _____. Their food consisted of _____." Most of the children failed to fill the blanks, and Sturt was unable to determine the reasons for such failures. The "pictorial identification" test was designed to find out whether children would recognize and distinguish different historical epochs through pictures. Pictures shown were of: "1. Charles I with typical Cavaliers and Roundheads, 2. Ancient Britons, 3. A tournament in the time of Richard I." The children were asked five questions regarding the three pictures.

1. Who do you think these people are?
2. When did they live? (Answer any way you like)
3. What things in the picture tell you when they lived?
4. Give the name of any man or woman who was alive when these people were alive.
5. Give the date at which these people lived. Never mind if you have given it before; give it again. If you do not know at all, guess it, but then put "G" by your answer.

Answers to questions 1 in the "pictorial identification" test were mostly vague. In question 2, the youngest children mostly answered "long ago" rather than giving a definite date or period. Answers to questions 3 and 4 show that with the increase in age, there is a steady increase in the ability to note definite marks and names in connection with a period. In all age groups, most of the children guessed their answers to question 5.

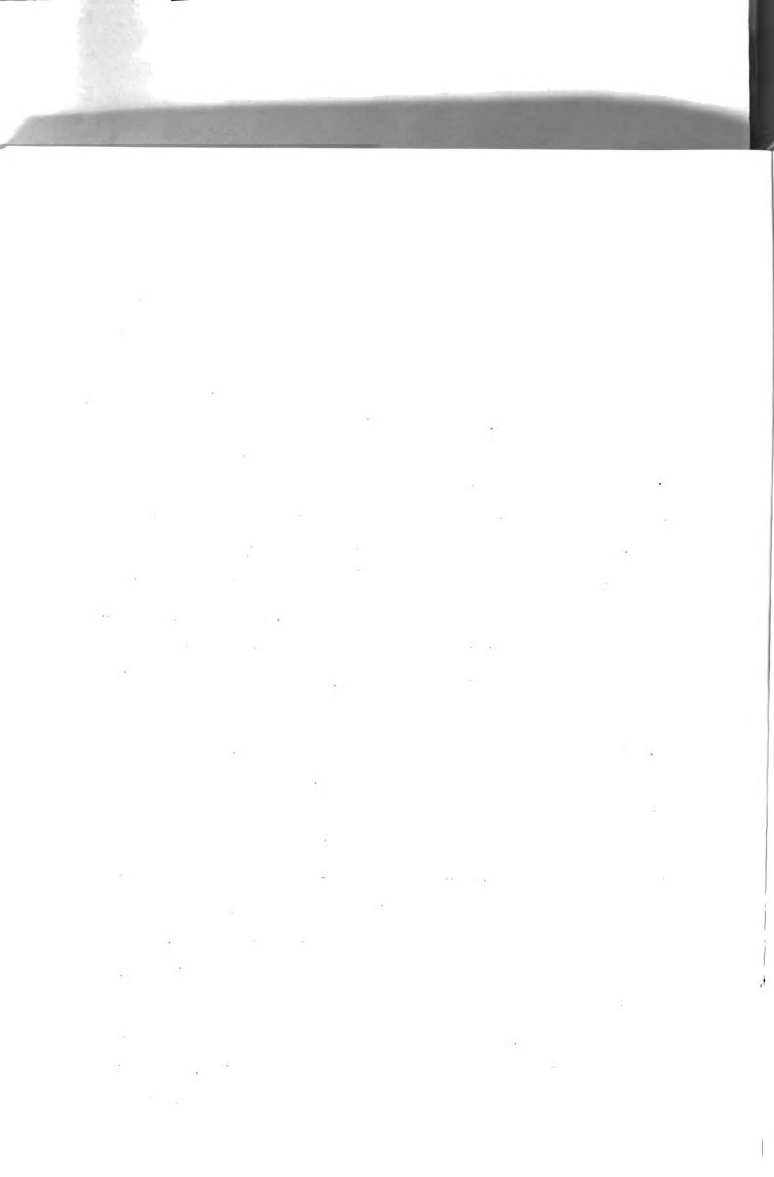
In the "temporal order of historical characters" test, the children were given five names of people which they were



asked to arrange in the order in which those people lived, and then to assign those people to their proper centuries. The test showed how little importance children give to dates, and a general tendency to put unknown people early, and group of people of the same occupation together. In the "temporal memory" test, a reproduction of a story and a letter were used to see if the children would remember the time and place and other details in the story and letter. The test indicated that children have more difficulty remembering details than adults. In the "making an appointment" test, the children were instructed to "write a letter to a friend arranging to go out for a walk with him". Most of the children gave an indefinite time such as tomorrow or Tuesday afternoon as their time of meeting.

2. Time Concepts in Relation to Training and Maturation

An investigation by Pistor (22), was designed to assess the relative effects of maturation and instruction on the development of time concepts in children. Using 640 pupils ranging in age from 10-0 through 12-11 years, two experiments were conducted. The pupils were divided into two groups: the history group and the non-history group. The groups were equated on the basis of general intelligence, reading ability, and school achievement as measured by report card marks. No information was given on the instrument used to measure intelligence and reading ability. The major difference between the two groups was the type of social



studies work the pupils experienced in grades four and five. The first group had separate courses in geography and history, and the second group had geography as a subject and history was only incidental.

Experiment one was designed to determine whether time concepts are developed through instruction in history alone. At the beginning of sixth grade, a "Time Concepts Test" was administered to the two groups. The test consisted of four parts. The "Time-Order Relationship" test consisted of items each with five historical events to be ranked in chronological order. The "Time-Absurdities" test consisted of items each of which represents a situation of the past or present with five important elements, one element of which is absurd and does not belong. The pupils must cross out the one that is absurd. In the "Time-Analogies" test, two pairs of ideas were presented in each test item. The first pair is given complete and the second pair has to be completed from a multiple-choice list of items. The "Time-Causal Sequence" test contained items each of which presented a series of sequential events. The main theme must be selected, and the "next" event must be chosen from a multiple-choice list of possible "next" events. Test results show that the pupils who received instruction in history during grades four and five, did no better than the pupils without such instruction. In other words, Pistor concluded that instruction in history apparently had no effect upon the development of time con-

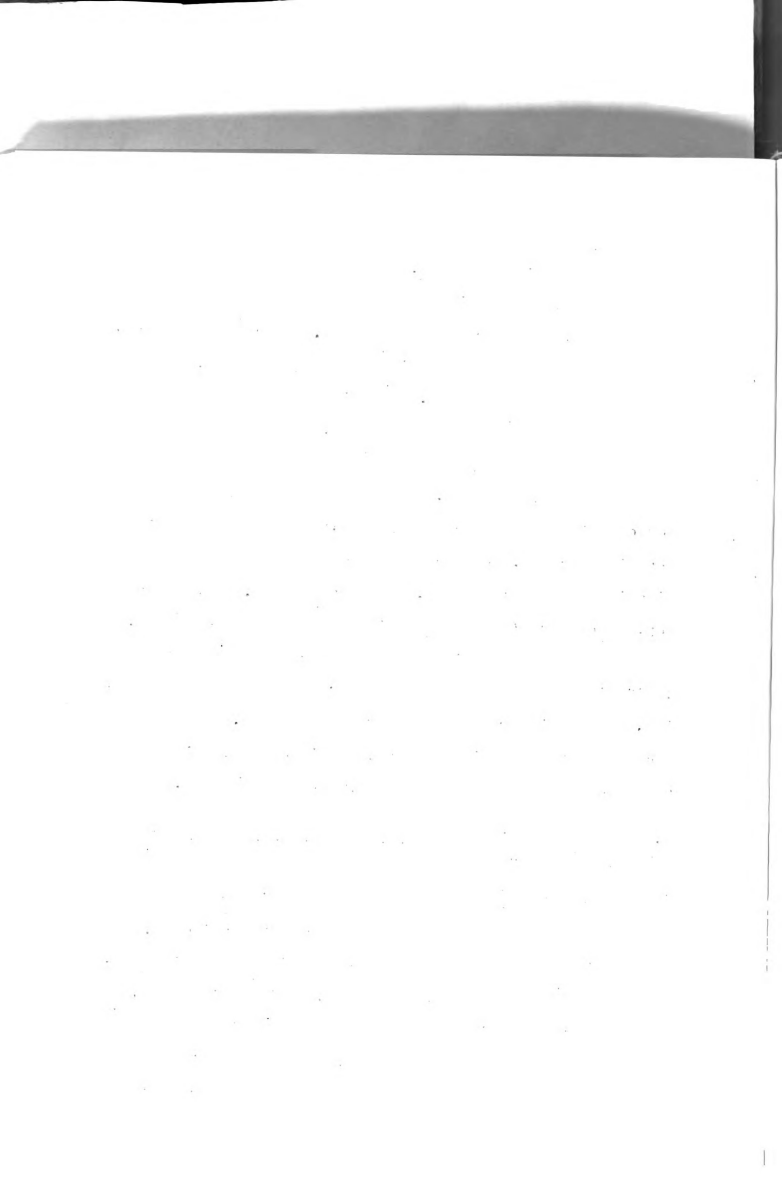
cepts of the pupils studied.

In a second experiment with the same groups and following the same method of instruction, the children carried on their work in social studies through grade six. At the beginning of seventh grade, the "Time Concept Test" was again administered to the two groups, to determine the amount of growth made by each group and to compare the growth of the two groups. Test results show that the group without history instruction did as well as the group with such instruction. Test scores for both groups showed definite improvements; however, Pistor concluded, that these improvements could not be attributed to maturation alone. He stated that the pupils were subjected to many other educative influences such as free and undirected library reading, motion pictures that the pupils attended, and radio programs that they listened to at their own free time that could have influenced their performance on the test.

3. Time Concepts in Relation to Intelligence and Other Factors

Harrison (11), reported an investigation on the nature and the development of time concepts of young children. Using fifty of the most commonly used time expressions selected from eight vocabulary studies, he interviewed 160 children from the kindergarten through the third grade. The responses to the time words were recorded as showing:

1. comprehension of general idea and specific facts



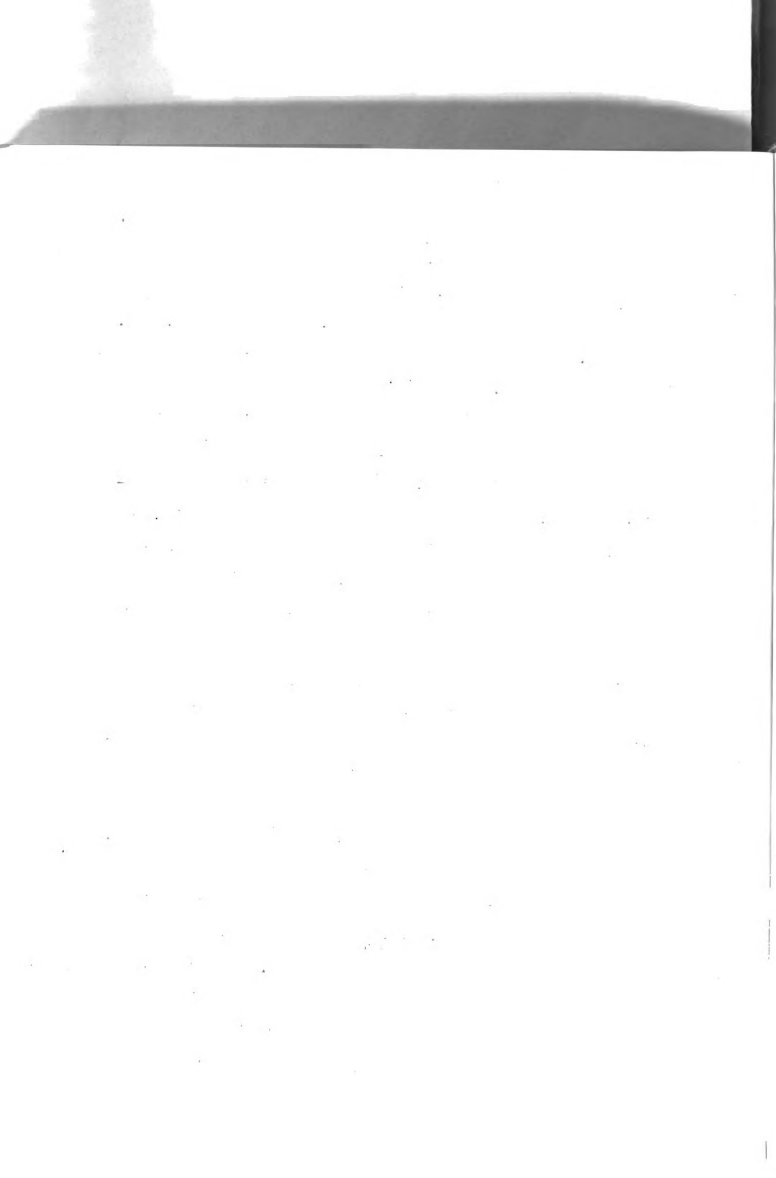
- (complete comprehension)
2. comprehension of general idea but knowledge of no specific facts (partial comprehension)
 3. comprehension of general idea but incomplete knowledge of specific facts (partial comprehension)
 4. comprehension of partial facts but no comprehension of general idea (partial comprehension)
 5. confused comprehension, shown by the giving of both right and wrong answers
 6. complete misconception in general idea and specific facts
 7. complete lack of comprehension, shown by no responses and don't know answers

The percentages of the various types of responses to the fifty time expressions were determined. The data show that the development of time concepts has a substantial relationship to grade level. A correlation of .66 was found between the two factors.

The responses to the fifty time expressions were then grouped according to the intelligence quotients of the children. A correlation of .70 was found between the grasp of time concepts and intelligence quotients. Between grasp of time concepts and chronological age, a correlation of .58 was reported. Based on the obtained correlations, Harrison concluded that the development of time concepts is in closer agreement with intelligence quotients than with chronological age. He did not give any information about the intelligence measures used.

Friedman (7, 8), carried on an investigation aimed primarily at finding out what pupils understand about "our conventional time system". Using 697 pupils enrolled from kindergarten through the sixth grade, he administered two sets of tests about time concepts. The first test which he

called "the primary test", consisted of seventeen questions related to time concepts, which were asked in personal interviews to children in kindergarten, and grades one, two, and three. Examples of questions asked were: "Is this morning or afternoon?", "How old are you?", and "What time is it?" When the children were requested to "tell something that happened a long time ago", and "tell something that happened a short time ago", most of the children were puzzled. However, percentages of correct responses indicated a better understanding of the concept "a short time ago" than the concept "a long time ago". The second test which Friedman called the "intermediate test" was a written test for grades four through seven. It was composed of four parts. The first part was very similar to the questions given to the primary grades. Percentages of correct responses showed that the intermediate grade pupils have better understanding of the indefinite time concepts than the primary grade pupils. The other parts of the intermediate test involved time words and dates, chronological sequence, and time line. The part dealing with time words and dates contained multiple-choice questions to test understanding of words such as eternal, B.C., and generation. It also presented dates which pupils translated into centuries. The part involving chronological sequence contained eight groups of 4 events each to be numbered in chronological order. In the last part of the test, a time line was presented and the



pupils were directed to locate the points at which seven stated events occurred. It was noted that by the time children are in the sixth grade, they have a satisfactory comprehension of "our conventional time system". Placing events in chronological sequence showed continued progress by grade.

Friedman also studied the relationship of the test scores to other factors such as sex, intelligence, and socio-economic status. He, like Harrison (11), and Pistor (22), gives no information regarding intelligence measures used. Coefficients of correlations between intelligence quotients and the scores on the last three parts of the test were as follows: with words and dates test .44; with chronological sequence test .38; and with time line test .21. Also, coefficients of correlation between socio-economic status and the same three test scores were .17, .24, and .02 respectively. Sex differences were found to be statistically insignificant.

4. Estimation of Time Duration

Goldstone, Boardman, and Lhamon (10), carried on an experiment to compare the accuracy of estimates of a second using the counting procedure and passive estimates. One hundred ninety children from age six through fourteen years, twenty young adults, and twenty older adults were asked to estimate 30 seconds under two different conditions: (1) by estimating without tapping and without vocalization, (2) by counting out loud and without restrictions as to tapping.

Five trials were obtained for each condition and the average time of the five trials was computed. The average 30 seconds was divided by 30 to approximate the subject's estimate of a second. Comparison of results show that considerable accuracy was attained in the estimates of a second by the eight year olds through young adult groups. The estimates of a second by the six and seven year olds and older adults were found to be shorter and less accurate than the estimates of the eight year olds through young adult groups. Comparison between the two methods showed estimates of a second were longer when counting aloud than when estimating to one's self.

A somewhat similar experiment to that of Goldstone, et al., (10), on estimation of time duration was conducted by Gilliland and Humphreys (9). With 48 fifth grade children and forty-eight college adults, a comparison was made of the ability to estimate, produce, and reproduce short intervals of time. Gilliland and Humphreys explained the meaning of estimation, production, and reproduction as follows:

In estimation, the subject was required to guess in seconds various lengths of time as marked off by the experimenter. In production, the procedure was reversed, the subject marking off for the experimenter stated time intervals. In reproduction, the subject has to mark off for the experimenter lengths of time (absolute length being known to subject) previously marked off by the experimenter.

Both the children's group and the adult group were divided into two. The first half of each group was allowed to

count while the second half was instructed to refrain from counting. For each judgment, per cent of error was calculated. Based on the data gathered, Gilliland and Humphreys concluded that adults are distinctly superior to fifth grade children in judging the length of short intervals of time. However, they noted that there is some evidence to indicate that children in the age level studied, have already developed certain cues for time estimation. No significant sex differences were found. The experimenters also concluded that counting is an important aid in time judgment. They further stated that "reproduction" of time intervals seems to be easier than "estimation" or "production".

5. Knowledge About the Appearance of the Clock

Springer (23), conducted a study to find out what children know about the appearance and operation of the clock prior to formal schooling. In individual interviews, she asked eighty-nine children from four through six years of age who were enrolled in a preschool, to draw a clock. After the drawing activity, the children were asked, "What time is it by your clock?" An analysis of the children's drawings was made, and the responses to the question and the spontaneous remarks that accompanied the drawing activity were compared between the various age levels. It was found that even the youngest subjects reveal in their drawings some knowledge of the clock, such as by drawing a circle to indicate the shape of the clock. It was noted that with the



increase in age, there is an increase in the number of drawings with (a) varied shapes; (b) with two hands, one long and one short; (c) with numbers placed around the edge of the clock; (d) with numbers written in a clockwise direction as opposed to a counterclockwise direction; (e) with numbers written correctly instead of reversed; and (f) with hands placed in position to represent an hour which the child can identify.

6. Time Concepts in Relation to Concepts of Speed

Piaget (21), in a discussion of the formation of time concepts states that the concept of time is not simply a function of perceptual data, but rather a progressive structurization of these data, which is accomplished by a sequence of logical operations.

Time as a logical concept has two aspects as given by Piaget: (1) the order of the succession of events, such as before, after, the same time; and (2) the duration of intervals separating successive events. Comparison of durations can be expressed by the relations of inequality of more or less than, or the relation of equality, the same; or it can lead to a system of measurements such as minutes, hours.

After a series of experiments, Piaget found that a child's judgment of simultaneity or successiveness in time depend on the equality or inequality of the speed of objects moving along the same path; and that a child evalu-

ates duration in terms of work accomplished or spatial distance covered. Once the coordination of operations of temporal succession and time duration are accomplished, then the child goes on to the organization of systems of time measurement. Prior to this time the child cannot gain much from the use of the clock because the child of four to six years of age does not understand that the speed of movement of hands on the clock are constant.

It was concluded that the construction of a system of measurements presupposes also the concept of speed; that the development of systematic time concept is dependent upon the understanding of concepts of speed.

Summary

Harrison's (11), and Friedman's (7,8), findings seem to show that there is a positive relationship between intelligence quotient and grasp of time concepts. However, in the reports of their studies, they did not give any information about the intelligence measures used, which is important in trying to prove the extent of such a relationship.

Harrison's study also shows evidence of a positive relationship of grade placement to grasp of time concepts. Kelty's (13, 14), and Friedman's investigations reveal similar trends about this relationship. Kelty noted in her study that from grade to grade, there is an increasing

preference for definite time expressions. Friedman concluded that by the time children are in the sixth grade, they have a satisfactory comprehension of "our conventional time system." Another study which seems to support Kelty's findings is that of Sturt (24), who reports that very young children seldom used dates and preferred using indefinite time expressions.

It seems that more research is needed to prove the extent of the relationship of sex and socio-economic status to time concept development. Friedman reports little relationship between socio-economic status and his test results, and found statistically insignificant sex differences. Gilliland et al., (9), also found no significant sex differences in the estimation of lengths of short intervals of time.

Harrison (11), reports a correlation of .58 between chronological age and grasp of time concepts. Springer's (23), investigations seem to confirm this relationship when she noted that with the increase in age, the children's drawings of the clock showed an increase in details correctly placed. Similarly, studies by Goldstone et al., (10), Gilliland and Humphreys, and Sturt, show that adults are more accurate than children in their judgment of time intervals and in remembering details about time.

Regarding children's use of the different time expressions, it seems that children tend to use first, words



about the present, then words about the future, and lastly words about the past. Mastery of time concepts seems to appear in stages as manifested first, by waiting, then by using the word spontaneously, and then by answering correctly questions related to time. These findings are reported by Ames (1).

Wann et al., (28), came to the conclusion that children learn more from episodes in their everyday experiences than from the logical organization of learning experiences.

Pistor's (22), investigations seem to show that children develop time concepts through maturation alone, and showed evidence that instruction in history has no effect upon the development of time concepts in children.

Piaget (21), found that children tend to judge simultaneity and successiveness in time upon the equality or inequality of the speed of objects moving along the same path. It was also noted that children tend to evaluate duration of time in terms of work accomplished or spatial distance covered. These point out that the development of the concept of time is dependent upon the understanding of the concept of speed.

In summary, the following statements would seem to be supported by evidence:

1. From grade to grade there seems to be an increasing preference for definite time expressions and an increasing ability to comprehend time.

2. Adults are more accurate in their judgment of time and in remembering details about time than children.
3. There appears to be a positive relationship between the development of time concepts and chronological age.
4. There is evidence to support the hypothesis that a fairly substantial positive relationship exists between development of time concepts in young children and intelligence.
5. Available evidence does not support the existence of significant sex differences in the development of concepts of time in children.
6. There is some evidence of a positive correlation between socio-economic status and the development of time concepts in children.
7. There is evidence to support the idea that the development of systematic time concept is dependent upon the understanding of concepts of speed.





CHAPTER III

PROCEDURE AND METHODOLOGY

Evidence from the review of literature and the available investigations of the nature and development of time concepts in young children leave the answers to important questions in doubt. Obtained results have been somewhat indefinite and inconclusive. The studies that have attempted to establish the extent of the relationship of time concepts to certain factors have not been as objective as they could be. No information has been supplied by the investigators regarding the quality of their measures.

The present study is similar in part to some of the studies reviewed in Chapter II. It is an attempt to present a quantitative and qualitative description of the nature and development of time concepts in elementary school children. Through the use of more refined and reliable measuring instruments, the study also attempts to present more conclusive and definite evidence on the extent of the relationships of time concepts to intelligence quotient, mental age, and chronological age; and more evidence on the significance of the differences between the performances on the Time Concept Test when pupils are grouped according to sex, grade placement, and socio-economic status.

Design of the Study

The Time Concept Test

The preliminary form of the test. (See Appendix A) The content and items for the Time Concept Test were based on the publications of the National Council for the Social Studies^{1,2}, on the types of questions found in the literature reviewed in Chapter II, and from a list by Wesley³, of the most commonly used time expressions. It was decided to attempt to construct a test that would be within the experience level of pupils in grades two through six; that would provide a range of difficulty from simple to complex concepts of time; and, that could be easily administered and scored. With regard to the above criteria, five general types of questions were included in the test with a total of ninety-seven items in all. These types of questions included the following categories of time concepts:

- a. telling time by the clock
- b. knowledge and understanding of time divisions such as seasons of the year, holidays, and other definite time expressions

1 Willcockson, Mary, ed., Social Education of Young Children, Washington, D.C.: National Council for the Social Studies, 1956.

2 Klee, Loretta, ed., Social Studies for Older Children, Washington, D.C.: National Council for the Social Studies, 1952.

3 Wesley, Edgar Bruce, Teaching the Social Studies. Boston: D.C. Heath and Company, 1942, p.266



- c. knowledge and understanding of opposites of some indefinite time words
- d. knowledge and understanding of the various activities related to the different seasons of the year
- e. note of the relationship of the different time expressions to each other
- f. application of understanding of time words through the estimation of lengths of each period of time presented.

Using the above categories as the structure of the test organization, parts and items were devised as follows:

Part I consisted of 20 matching items. Pictures representing the face of the clock were presented and the children were asked to tell the time shown on each.

Part II contained 30 true-false statements dealing with time divisions such as seasons of the year, holidays, and other definite time expressions. For example:

1. There are twelve months in a year.
2. The year 4 B.C. comes after the year 2 A.D.

Part III was made up of 12 multiple-choice items wherein the children were asked to choose from a group of indefinite time words the opposite of a given time word. For example:

1. old - A. ago B. once C. ever D. young

Part IV consisted of 30 items using analogies dealing with the various activities related to the different seasons of the year and the relationship of the different time expressions to each other as shown in the following examples:

1. Summer is to swimming as Winter is to ____.
A. skiing B. windy C. snowing D. cold
2. Days are to months as minutes are to ____.
A. hours B. time C. clock D. seconds

Part V contained 15 items. Groups of time words of different lengths were given, and in each group the children were asked to put a cross before the word that tells the shortest period of time, and to put a circle before the word that tells longest period of time. For example:

1. ____hour, ____minute, ____second

The subjects for the trial of the preliminary form. For purposes of test tryout and item analysis, the preliminary form of the test was administered by the present investigator to pupils in grades two through six at William Donley School in East Lansing, Michigan, during the school year 1963 - 1964. Number of pupils tested in each grade were: Grade VI - 26; Grade V - 26; Grade IV - 26; Grade III - 26; and, Grade II - 30; or a total of 136. The pupils were each given a copy of the test and the directions for each part were read to them and the examples were worked out. Pupils

proceeded at their own rates and when most of them were done for one part of the test, they were all told to stop and continue to the next part. The length of time it took most of them to finish each part of the test was noted. For all the grades, it took an average of forty-five minutes to finish the whole test.

The item analysis. After the test was tried out and the papers were scored, the results were analyzed. It was felt that if the item analysis were based on only the upper and lower twenty-seven per cent of each grade, the number would be too small to provide reliable item statistics. It was decided, therefore, to base the item analysis on all of the 136 test papers, using the upper half and the lower half as a basis for item statistics. Item analysis was done by grades. For each grade, the papers were arranged in order of score, from highest to lowest, and then were divided into two groups - the upper half and the lower half. To find the difficulty level of each item for each grade, the percentages of the pupils getting the correct answer in each grade group was computed. For example, Item No. 1 for Grade III: there were 26 pupils in Grade III, and so, the upper and lower groups were composed of 13 pupils each. In the upper group, 11 pupils or 85% answered the item correctly; in the lower group, 8 pupils or 61% answered correctly. The difficulty level for the whole group was $19/26$ or 73%. The discrimination index of each item in each grade



was determined by subtracting the number of the lower half getting the item right from the number for the upper half answering correctly, and dividing this difference by the number in each group. Thus, in the above example, the discrimination index was $\frac{11 - 8}{13} = .23$. Based on the difficulty level and discrimination index, the ranges for each item were then carefully studied. Though no absolute criterion points for discrimination index and difficulty level were established for eliminating items, the following criteria served as a guide:

1. Items with negative discrimination index in any grade levels were dropped.
2. Items were eliminated if they had discrimination index of zero in most of the five grade levels. In other words, if only one of the five grade levels had a discrimination index of zero, especially in grade six, the item was retained. It was expected that low discrimination indexes would be found in grade six, because of higher percentages of pupils getting the answers right.
3. Items with difficulty values of one hundred or zero in most of the grade levels were dropped. If the difficulty value of one hundred was found only in the sixth grade, the item was retained; and if the difficulty level was zero only in the second grade, the item was likewise included. This was done be-

was determined by subtracting the number of the lower half
getting the item right from the number for the upper half
answering correctly, and dividing this difference by the
number in each group. Thus, in the above example, the dis-
crimination index was $\frac{10-5}{10} = .5$. Based on the difficulty
level and discrimination index, the ranges for each item
were then carefully selected. Though no absolute criterion
points for discrimination index and difficulty level were
established for eliminating items, the following criteria
served as a guide:

1. Items with negative discrimination index in any
grade levels were dropped.
2. Items were eliminated if they had discrimination in-
dex or grade level below the live grade levels. In
other words, if only one of the live grade levels
had a discrimination index of zero, especially in
the lower grades, the item was dropped. It was expected
that the "average" student would be found in
the middle of the range of the percentages of pupils
getting the item right.

3. Items with a discrimination index of one hundred or zero
were dropped. Items with a discrimination index of one
hundred were found only in
the upper grades and items with a discrimination index of zero
were found only in the second grade.
4. Items with a discrimination index of one hundred or zero
were dropped. Items with a discrimination index of one
hundred were found only in the upper grades and items with a
discrimination index of zero were found only in the second grade.

cause it was expected that the test would discriminate between grades, besides discriminating within grades.

The ranges by grades of the discrimination index and the difficulty values of each item in the preliminary form are shown in Appendix B. To illustrate the procedure used in selecting and dropping an item: in Part I, Item 1, the range of discrimination index by grades was from $-.20$ to $.23$ and the item was dropped. In Part I, Item 4, the range of discrimination index was from $.07$ to $.54$ and the item was retained.

The final form of the test. In light of the item analysis and some experience gained in the tryout, the test was revised and a total of forty-six items were included in the final form (See Appendix C). The five parts in the preliminary form as described earlier were retained in the final form of the test. Part IV was interchanged with Part V in the final form to attain better format. The total number of items for each part in the final form was as follows: Part I, 10 matching items; Part II, 15 true-false items; Part III, 5 multiple-choice items; Part IV, six groups of time words; and Part V, 10 analogies items.

Administering the test. A total of thirty minutes was allowed to answer the whole test. For grades two and three, the directions for answering the test were read by the examiner, examples were worked out, and then the test was



read to the pupils word for word. The pupils all had a copy of the test and they followed along as the test was read to them, and wrote down their answers in the spaces provided in the test booklet. In grades four through six, the directions for answering the test questions were read by the examiner and the examples were worked out and from there the pupils proceeded at their own rates until time was up. However, words that the pupils were unable to read were read for them, but no further hint or explanations were given as to their meanings and connotations. This was done to lessen the effect of reading difficulty as a factor in the final scores of the test. It was found that the test was largely self-administering from grades four through six.

Scoring the test. Number of correct responses were counted and given one point each for part I, Part II, Part III, and Part V. Part IV required twelve correct responses and each correct response was given one-half point making a total of six points. The highest possible score for the whole test was 46.

Reliability of the test. After the final form of the test was administered and scored, the split-half technique of determining the reliability was used. Scores for the odd-numbered items and scores for even-numbered items were obtained for each subject. Coefficient of correlation between the odd and even scores stepped up by the Spearman Brown Prophecy Formula shows a reliability coefficient of

.93 for the whole group. Split-half (odd-even) reliability coefficients of the test by sex and by grades are shown in Table I.

Table I

Split-half Reliability Coefficients of the Time Concept Test

	Value of r
Whole group	.93
Boys	.92
Girls	.93
Grade II	.88
Grade III	.85
Grade IV	.88
Grade V	.84
Grade VI	.50

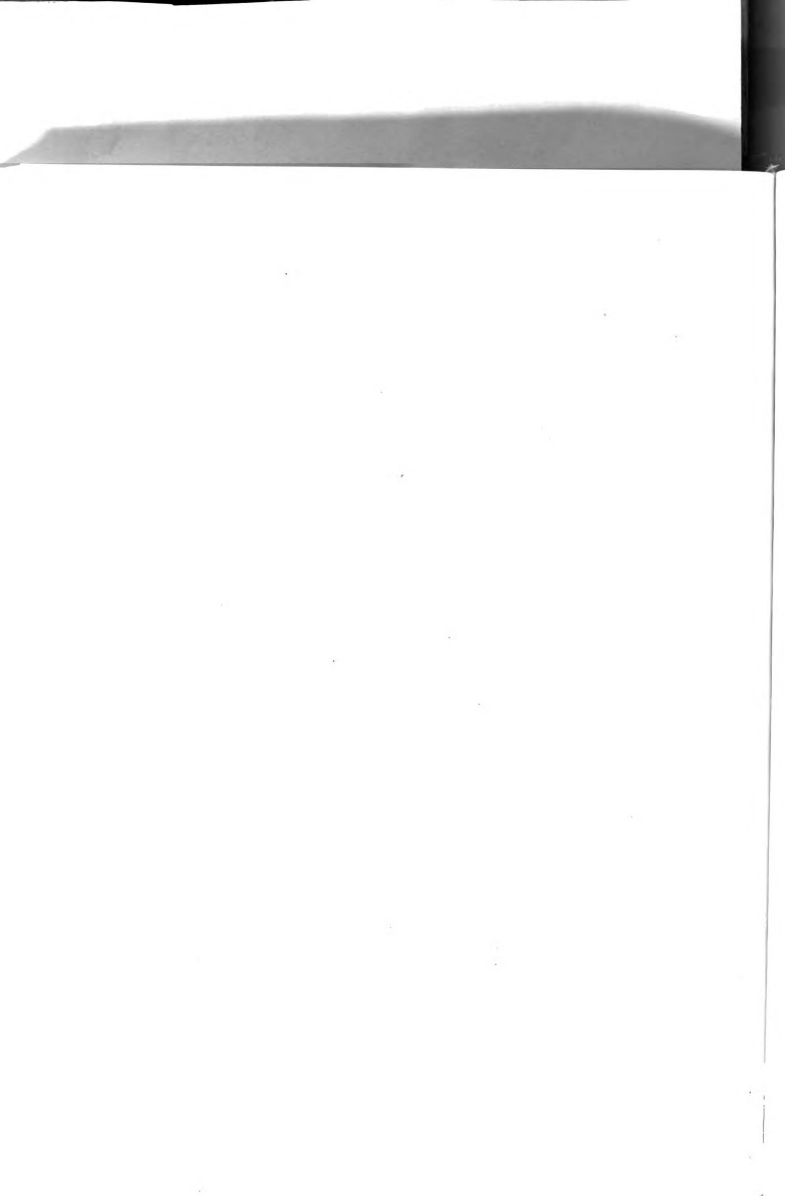
Noll (19, p.92), states that where a test is intended only for use in studying groups, a reliability coefficient of around .75 may be sufficient. Table I shows that all the reliability coefficients of the Time Concepts Test for Grade II to V range from .84 to .93. These are quite satisfactory for the purposes of this study. For Grade VI the reliability is .50. This could be explained as follows: it should be noted in Table VI (p. 64), that Grade VI had a range of scores from 36 to 46 with a standard deviation of 2.81. This shows that only a small proportion of the items

on the Time Concept Test were discriminating at the Grade VI level. In other words, it is evident that test sampling and item difficulty for Grade VI were inadequate. If more difficult items were to be included in the test, it is quite likely that the reliability for Grade VI would improve. Because the Time Concept Test was intended for a range of several grade levels, it can be expected that it would not discriminate equally well within each of the different grades. But as evidence shows it did discriminate quite satisfactorily in grades two through five. It is rather unfortunate that the reliability for Grade VI is no higher than .50; however, this does not mean that such a reliability coefficient is meaningless. The reliability coefficient of .50 still shows some degree of consistency though less than in other grades and below what would be desirable.

Validity of the test

Face validity. Face validity was considered in formulating the test items of the Time Concept Test. The items were worded in terms of children's experiences and vocabulary.

Content validity. In constructing the Time Concept Test careful analyses of Social Studies courses of study for grades two through six and other materials as indicated earlier in Chapter III was undertaken to insure that the test would have content validity. The content area to be tested was systematically analyzed to make certain that all



major aspects of time appropriate for the ages and grades tested were adequately and proportionately covered by the test items.

Construct validity. The purpose of the Time Concept Test was primarily that of finding the degree of knowledge and understanding of the concepts of time of elementary school children; that is, obtaining some measure (such as scores on the test) that could be taken as an indication of the probable knowledge and understanding of time concepts. By making arbitrary associations, for which there is no reason or explanation, a child shows the lowest level of understanding. The second level of understanding is shown when the child gives examples of the concept; and the highest level is shown in application. When the Time Concept Test was prepared, the three levels of understanding were considered although most of the items involved the second and third levels of understanding. It was hypothesized that there is a positive relationship between children's concepts of time and intelligence quotient. In other words, a child with a low score on the Time Concept Test is likely also to show a low IQ score; or, a child who shows a high degree of knowledge and understanding of time concepts will probably also show a high degree of intelligence. Since the Otis Quick-Scoring Mental Ability Tests are used mainly for measuring mental ability (in terms of IQ scores), it is important that there be some objective evidence of the relationship between performance on the Time Concept

Test and the Otis Tests. In Table II are shown the correlations between Otis IQ scores and the Time Concept Test scores by sex and by grades.

Table II

Correlation Coefficients Between Otis IQ scores and the Time
Concept Test Scores

	Value of r
Whole group	.40
Boys	.44
Girls	.39
Grade II	.44
Grade III	.41
Grade IV	.61
Grade V	.62
Grade VI	.50

Correlation coefficient for the whole group was .40 which was lower than the correlation coefficient for any grade level. This could be explained as follows: it should be noted in Table V, (p. 63), that the mean IQ for the grades ranged from 108 to 115 with a mean IQ for the whole group of 112. Table VIII, (p. 67), shows that mean score on the Time Concept Test increased progressively with grade. So, when the correlation coefficient for the whole group was computed, the range of the Time Concept Test scores

was increased while the range for IQ scores remained constant. In other words, an increase on the X-variable (TCT scores) brought almost no corresponding change on the Y-variable (IQ scores).

Figures 1 to 4 show the relation between IQ and TCT scores for the whole group, Grade VI, Grade V, and Grade III, respectively. These represent another test for linearity, where a line is drawn joining the means of the columns, regression of Y on X (or rows, regression of X on Y) (18, Ch. 12).

As the dispersion about the regression lines decrease, the higher the value of relationship and vice versa. Also, as the lines of regression approach the linear form with a value of one, the higher the value of relationship and the closer the regression lines approach identity. The more widely the regression lines depart from each other, the lesser the value of relationship. These explain further the small r value for the whole group. It can be seen in Figures 1 and 4 that the two regression lines for each of the figures depart materially more from each other as compared to the regression lines in Figures 2 and 3, where the regression lines are closer to identity and approach closely the linear form with a value of one. Also, it can be seen that the dispersion about the regression lines in Figures 1 and 4 are greater than the dispersion in Figures 2 and 3, which clearly shows that the value of relationships in Figures 1 and 4 would be lesser than in Figures 2 and 3.

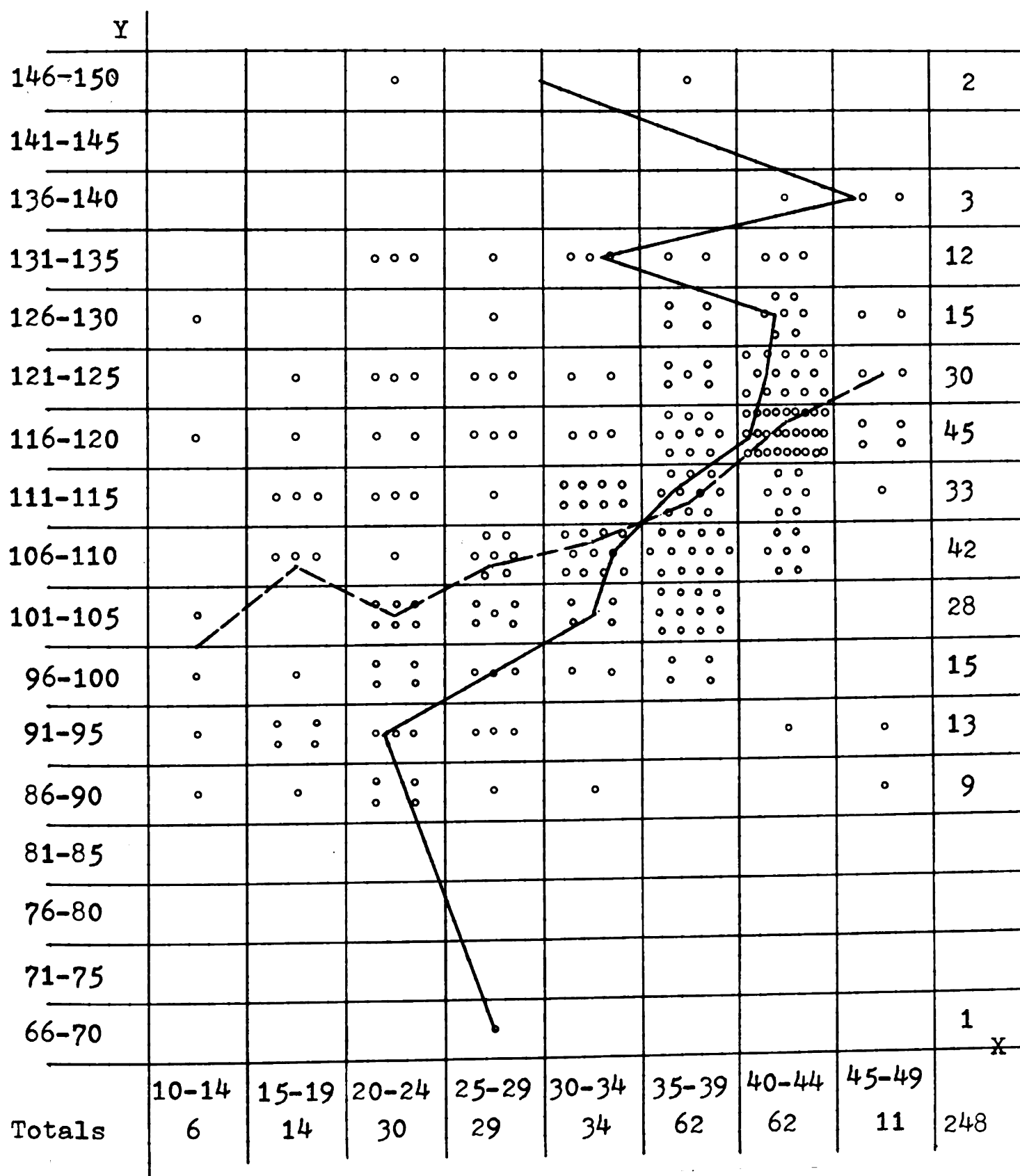


Figure 1. Scatter diagram showing the relation between IQ and TCT scores ($N = 248$), and regression lines of Y on X, and X on Y.

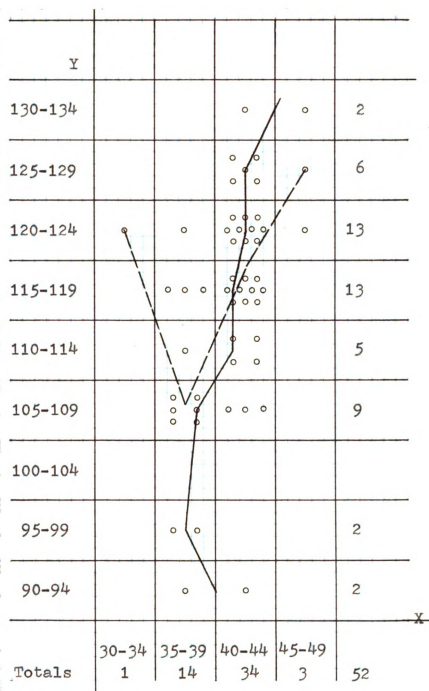


Figure 2. Scatter diagram showing the relation between IQ and TCT scores (Grade VI), and regression lines of Y on X, and X on Y.

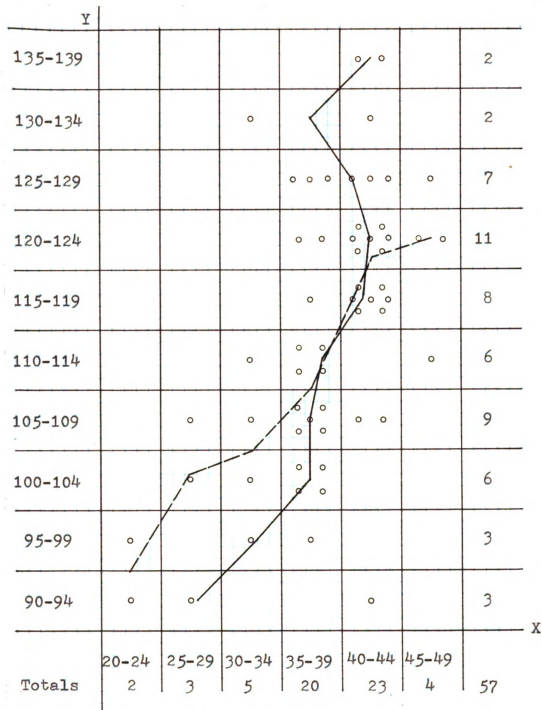


Figure 3. Scatter diagram showing the relation between IQ and TCT scores (Grade V), and regression lines of Y on X, and X on Y.

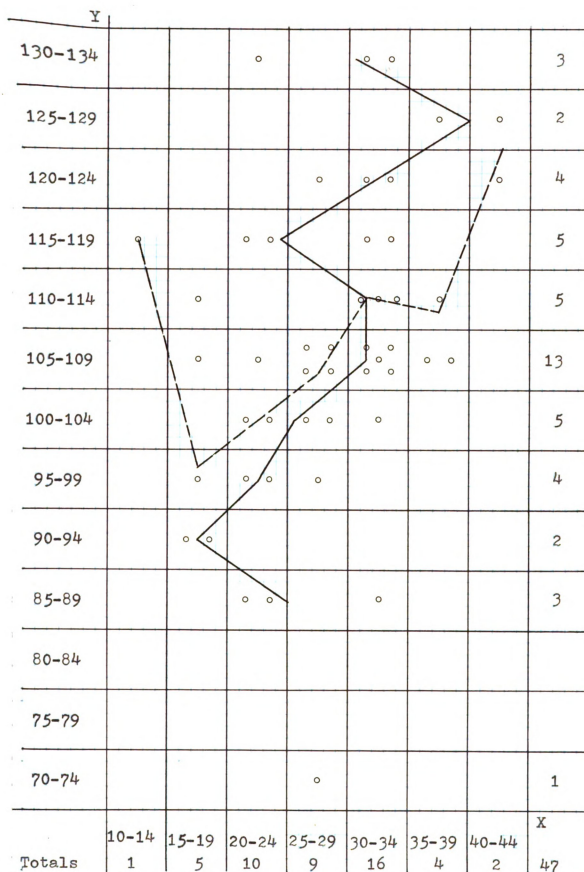


Figure 4. Scatter diagram showing the relation between IQ and TCT scores (Grade III), and regression lines of Y on X, and X on Y.

It was also hypothesized that there is a positive relationship between children's concepts of time and mental age; therefore, it is just as important that there be some objective evidence of the relationship between the Time Concept Test scores and Otis MA scores. Table III shows the correlation coefficients between Otis MA scores and the Time Concept Test scores by sex and by grades. For the whole group the value of r was .78.

Table III

Correlation Coefficients Between Otis MA scores
and the Time Concept Test Scores

	Value of r
Whole group	.78
Boys	.77
Girls	.79
Grade II	.51
Grade III	.37
Grade IV	.60
Grade V	.36
Grade VI	.52

No general answer can be given on how high a validity coefficient should be, since interpretation of such a coefficient must take into account various other factors such as the use which is made of the test scores. Most validity



coefficients of existing tests rarely exceeds .60 or .70 which makes its use for individual prediction almost impractical, because a very high validity coefficient is needed to be able to use it effectively for predicting the specific criterion performance of individual cases. In most testing situations, however, what is necessary is to determine which individuals will exceed a certain minimum standard of performance, or cut-off point in the criterion. Anastasi (2, p. 133), states that when used for screening purposes, a test may appreciably improve predictive efficiency if it shows any significant correlation with the criterion, however low.

The Intelligence Test

For the intelligence measures, the Otis Quick-Scoring Mental Ability Tests - Alpha Short Form for grades two and three, and Beta Form CM for grades four through six were used for the following reasons:

1. The test is one of the most widely used and well-constructed group intelligence tests.
2. The test has been established as a reliable measure of intelligence at the age levels in question.
3. The scores derived from this test are readily subjected to appropriate statistical analysis.

The Alpha Short Form yields only one IQ score although it includes both verbal and non-verbal material. The content

is entirely of pictures and geometric forms. Split-half (odd-even items) reliability coefficients corrected by the Spearman Brown Prophecy Formula were .87 and .88 for two norm samples of third grade pupils. The standard error of measurement of a score is 4 score points. Twelve minutes is allowed to finish the first part of the test. For the second part, after each verbal direction has been given, the pupil is allowed five seconds of working time in which to mark each picture. It takes about 30 minutes altogether to finish the whole test.

The content of the Beta Form CM is entirely verbal. Split-half (odd-even items) technique was used to determine the reliability of the test. The test was given to a norm sample of pupils from grade four through nine, and the average of the six correlation coefficients corrected by the Spearman Brown Prophecy Formula is .87. The standard error of measurement is 4 score points. Thirty minutes is allowed to finish the whole test.

The Socio-Economic Status of the Pupils

Most families usually have the father as the chief if not the only means of support. The type of work the father does largely determines the family's place of residence and the family's associates and acquaintances. Thus, in most studies involving socio-economic status, the father's occupation has been commonly used as the most valuable single



item of information in determining the socio-economic level of an individual or family. In this study, the pupils' father's occupation and his years of schooling were used as the basis for classifying pupils on a scale of socio-economic status. Through the school records and the data sheets filled out by the pupils with the help of their respective teachers, data on the father's occupation and the amount of education the father had was obtained. The father's occupation was then classified into five occupational groups according to the Socio-economic Scale by Kefauver, Noll, and Drake (12). The divisions of the scale are as follows:

I. The Professional Group

1. Large owners and proprietors (more than 50 workers)
2. The professions
3. Executives (more than 100 workers)

II. The Semi-professional Group

4. Middle owners and proprietors (6 to 50 workers)
5. Semi-professional workers
6. Managerial workers (11 to 100 workers)

III. The Skilled Group

7. Skilled small owners (0 to 5 workers)
8. Supervisory workers
9. Commercial workers
10. Clerical workers
11. Building trades
12. Machine and related trades
13. Printing trades
14. Transportation and communication workers

IV. The Semi-skilled Group

15. Manufacturing, mechanical, and production workers
16. Transportation and communication workers
17. Semi-skilled owners and proprietors (0 to 5 workers)
18. Small agents and managers (1 to 10 workers)
19. Public service
20. Personal service

V. The Unskilled Group

21. Common labor

VI. Occupation Unknown

22. Unknown and unclassified

Notes on the occupational classifications used in each group and the lists of occupations represented are given in full in the bulletin to aid in interpreting the groupings. For example, in the lists of occupations under the professions are listed: architects, chemists, lawyers, teachers, professors, and so forth. Under the listing of semi-professional workers are included: actors, cartoonists, chiropractors, photographers, and so forth. The scale permits rather fine distinctions provided the necessary information can be obtained for each individual. However, in the present study, only the father's occupations and highest grade in school completed could be obtained. Since the present study did not seem to require a finely differentiated classification of occupations, the information available was considered adequate for the purpose. That is, the occupations were classified as well as could be done on the basis of the occupation per se and the amount of education the father had, wherever this was available. There were five pupils in the sample without fathers, either deceased or whereabouts unknown, so, the sixth category was stated as "no father" instead of "unknown and unclassified occupation". It was found that an unusually large proportion of the fathers'

occupation belonged in the professional group. This was due to the fact that Okemos is located within the immediate vicinity of Michigan State University and the fathers of many of the children are members of its faculty.

Other Factors

It was hoped that the present study, besides making a contribution to the field in the form of an objective test with known reliability and validity, would to some degree also, contribute additional evidence on some of the questions left in doubt by previous studies. Grade, chronological age, and sex were readily available from pupils' school records which facilitated obtaining data on these factors and relating them to scores on the test of time concepts.

The Subjects

The Time Concept Test and the Otis Quick-Scoring Mental Ability Tests were administered to a sample of pupils in grades two through six, enrolled in Okemos Public Schools during the school year 1964 - 1965. Because of the proximity of Okemos to Michigan State University, this school system was chosen for the study. All groups were tested by the investigator with both the Time Concept Test and the Otis Tests, and every effort was made to maintain the same physical testing conditions for all the subjects.

Statistical Procedure

After the test were administered and scored, the results were tabulated into frequency distributions. To determine the relationship of time concepts to intelligence, coefficients of correlation between the scores on the Time Concept Test and the Otis IQ and MA scores were computed. To determine the significance of differences between Time Concept Test scores by sex, grade, and socio-economic level, the analysis of variance technique was used.



CHAPTER IV

ANALYSIS AND DISCUSSION OF THE DATA

To test the hypotheses presented in Chapter I and to determine the extent of the relationship between time concepts in young children and certain other factors, correlations between the different factors and the Time Concept Test scores were computed and an analysis of variance design was used. The Time Concept Test and the Otis Quick-Scoring Mental Ability Tests were administered to a sample of pupils from grades two through six, and data on chronological age, grade, sex, and socio-economic status were collected.

Table IV gives the distribution of pupils by sex and by grade in each school included in the study. The sample was composed of 135 boys and 113 girls for all the grades or a total of 248 pupils. There were approximately equal number of pupils in each grade. In Grade II there were 41 pupils; Grade III - 47; Grade IV - 51; Grade V - 57; and Grade VI - 52. It should be noted that Grade VI pupils all came from Central School, which is a Junior High School. Okemos Public School system is organized so that elementary schools include kindergarten to Grade V only, and Grade VI is the first year of Junior High School. The sex distribution in each grade per school was very unequal. Pupils of

"matching personalities" as recommended by the previous teachers had been assigned to homerooms regardless of sex and intelligence. (Information was given by the Office of the Principal, Wardcliff Elementary School). In grades four and five there were almost twice as many boys as girls in each class. The situation is reversed in grade three where there were 16 boys and 31 girls. However, in the total sample there were 135 boys and 113 girls giving a preponderance of boys in a ratio of approximately five to four.

Table IV

Distribution by Sex and Grade of Pupils in Each
School Included in the Study

Grade	Schools								
	Central			Cornell			Wardcliff		
	B	G	T	B	G	T	B	G	T Totals
Two				11	8	19	8	14	22 41
Three				6	16	22	10	15	25 47
Four				18	10	28	16	7	23 51
Five				20	11	31	15	11	26 57
Six	31	21	52						52
Totals									
Boys	31			55			49		135
Girls		21		45			47		113
Pupils in each school		52			100			92	248

Table V gives the data on chronological ages and the Otis MA and IQ scores by grades. The chronological ages subjects as a whole ranged from 7-0 to 12-10; the mental ages ranged from 6-7 to 16-10; and the intelligence quotients ranged from 70 to 150. CA, MA, and IQ range show an increasing trend through grade five.

The means for CA, MA, and IQ show progression through the grades except that IQ mean for grade two was higher than the IQ means for grades three and four. This was due to a great number of pupils with high IQ's in the second grade at one of the schools. Means for CA show almost exactly twelve months difference between grades which indicates a normal population based on chronological ages. It also indicates a normal progression through the grades on the average though there is a range in CA's in grade two of over a year and this gradually increases to twenty-six months in grade five. In grade six it shrinks slightly to twenty-one months.

IQ standard deviations show decreasing variability with the increase in grade; and CA and MA standard deviations show increasing variability through grade five. Grade five shows the greatest variability in CA and MA scores. Everything shows greater homogeneity in grade six than in grades two to five.

Both IQ and MA were considered because of the differences in nature between the two scores. IQ's are trans-

mented scores and chronological age is inherent in such scores, while MA scores are raw scores. IQ's furnish an index of the degree of brightness as they take into account the age of the subject, whereas mental age alone does not. To compare performances between mental age levels, it is necessary to use MA scores.

Table V

Chronological Ages, Otis Mental Ages, and Otis Intelligence
Quotients of Pupils by Grades

	Grades				
	2	3	4	5	6
<u>CA*</u>					
Mean	91.07	104.11	116.00	127.95	139.21
SD	3.80	4.21	4.93	5.08	4.74
Range	84-100	97-117	109-132	118-144	133-154
<u>MA*</u>					
Mean	106.27	120.38	135.51	152.46	169.96
SD	17.26	20.64	18.97	31.45	17.77
Range	80-155	79-155	106-184	113-200	127-202
<u>IQ</u>					
Mean	113.85	108.47	110.24	114.49	115.63
SD	15.12	12.66	11.10	11.31	9.23
Range	88-150	70-133	88-138	92-138	90-133

* in months

The first comparison to be made was based on correlations between Time Concept Test scores and chronological ages, mental ages, and intelligence quotients. These are shown in Table VI.

Table VI

Correlations Between Scores on the Time Concept Test and Chronological Ages, Mental Ages, and Intelligence Quotients

Scores on TCT for	CA	MA	IQ
Whole group	*.70	.78	.40
Boys	.64	.77	.44
Girls	.76	.80	.39

*All values of r are significant at 1% level of confidence.

It can be seen that values of r show a positive relationship between Time Concept Test scores and each of the three measures. All values of r are significant at the one per cent level. Consequently, we reject the hypothesis that any r is zero in the population from which the samples were drawn. This implies that there would be less than one chance in 100 of obtaining sample r 's like those obtained if the population r were zero. These results suggest that intelligence quotient, mental age, and chronological age are significant factors in the development of time concepts in children. Also, these results are in the direction hypothesized and are in agreement with the findings of Harrison (11),

and Friedman (7, 8). It appears that these positive relationships could be expected on the basis that IQ and MA scores are reflecting the ability of the subjects to deal with time concepts; and on the basis that as young children increase in age, an increase in experience could be expected, hence, an increase in the concepts acquired.

However, there are apparent differences between the degree of relationship. The data indicate substantially higher relationships between the Time Concept Test scores and chronological ages and mental ages than with intelligence quotients. In order to determine whether this difference is significant, Hotelling's method (27, p. 256), was used to test the significance of the differences between these correlation coefficients and the results are shown in Table VII.

Table VII

Significance of the Differences Between Correlation
Coefficients on the Time Concept Test Scores

Correlations between	r_{xy}	t value	p
CA and MA	.70	27.20	.005
MA and IQ	.68	12.54	.005
CA and IQ	.009	1.35	*---

*not significant

The t values between CA and MA, and between MA and IQ show that the differences are significant at better than one per cent level of confidence. Therefore, it can be concluded that TCT scores are more highly related to mental age than to chronological age. It also shows that MA correlates significantly higher than IQ with TCT scores. However, the small value of t between CA and IQ indicates that the difference is not significant and it cannot be concluded that TCT scores are more highly related to IQ than to CA. This statistically insignificant difference is due to the very low (.009) correlation coefficient between CA and IQ. In light of the hypotheses, data support part of hypothesis IV that time concepts are more closely related to mental age than to chronological age, but do not support the other part of the same hypothesis that time concepts are more closely related to intelligence quotient than to chronological age.

Table VIII presents data concerning the performance of the five grade levels on the Time Concept Test. For the whole group, the range of scores was from 11 to 46, with a mean score of 33.20 and a standard deviation of 8.86. Mean scores show a steady increase by grades. Grade VI had a standard deviation of 2.81 which indicated the least variability and Grade III showed the greatest variability with a standard deviation of 7.15. The ranges of scores show that the test evidently did not have sufficient difficulty for

the best pupils particularly in the upper grades, since some in almost every grade made high or near perfect scores. Two pupils in Grade V and one in Grade VI made perfect scores.

Table VIII

Ranges, Means, and Standard Deviations of the Scores on the
Time Concept Test by Grades

Grade	Range	Mean	Standard Deviation
All grades	11 - 46	33.20	8.86
Grade II	11 - 39	21.85	6.68
Grade III	11 - 42	27.66	7.15
Grade IV	21 - 43	34.08	6.02
Grade V	20 - 46	38.08	5.69
Grade VI	34 - 46	40.90	2.81

Analysis of variance technique requires that three assumptions be met so as to accept conclusions based upon the use of table of F values. These assumptions are : normality of population, equal variances for the population, and random selection of subjects.

Test for equal variances on the TCT scores by grades was not satisfied. However, Underwood, et al., (25, p. 194), states that even if one or two of the assumptions for analysis of variance technique appears not to be met, the practical usefulness of the procedure may still be nearly as great

as when all are satisfied. The experimenter may prefer to interpret the results conservatively (e.g. require that his F values reach the tabled values for the 1% level for significance when he would otherwise have required only a 5% level for concluding that F is significant).

Table IX

Summary of the Analysis of Variance of the Time Concept
Test Scores Grouped According to Grade

Source of Variation	Sum of Squares	df	Mean Square	F	p
Between groups	11227.90	4	2806.97	85.53	.005
Within groups	8166.02	243	33.61		
Total	19393.92	247			

Table IX shows that there is a statistically significant difference at better than 1% level of confidence between the performance of pupils in grades two through six on the Time Concept Test. Because of the large value of F (85.53), conservative interpretation of the results still show significant differences between the pupils' performance on the Time Concept Test, when grouped according to grade. Since there is a correlation of .70 between scores on the Time Concept Test and chronological age, one could expect scores to increase with grade level. Harrison (11), in his study found a correlation coefficient of .66 be-

tween the development of time concepts and grade level, which supports the findings of the present study.

Table X

Data on the Time Concept Test
Scores Grouped According to Sex

Category	Frequency	Mean	Standard Deviation
Male	135	34.36	8.28
Female	113	31.81	9.36

Table X shows that the male group did better on the Time Concept Test than the female group. The data also show that the male group is slightly less variable than the female group, with standard deviations of 8.28 and 9.36 respectively.

Table XI

Summary of the Analysis of Variance of the Time Concept Test
Scores Grouped According to Sex

Source of Variation	Sums of Squares	df	Mean Square	F	p
Between groups	399.61	1	399.61	5.85	.03
Within groups	18994.31	246	77.21		
Totals	19393.92	247			

1. The first part of the report deals with the general situation of the country and the progress of the work during the year. It is divided into two main sections: the first section deals with the general situation of the country and the progress of the work during the year, and the second section deals with the specific results of the work.

2. The second part of the report deals with the specific results of the work. It is divided into three main sections: the first section deals with the results of the work in the field of research, the second section deals with the results of the work in the field of education, and the third section deals with the results of the work in the field of administration.

3. The third part of the report deals with the conclusions and recommendations. It is divided into two main sections: the first section deals with the conclusions, and the second section deals with the recommendations.

4. The fourth part of the report deals with the appendix. It contains a list of the names of the members of the committee, a list of the names of the members of the staff, and a list of the names of the members of the public.

5. The fifth part of the report deals with the bibliography. It contains a list of the books and articles that have been consulted during the preparation of the report.

6. The sixth part of the report deals with the index. It contains a list of the names of the subjects and topics that are mentioned in the report.

7. The seventh part of the report deals with the list of figures and tables. It contains a list of the figures and tables that are included in the report.

8. The eighth part of the report deals with the list of abbreviations. It contains a list of the abbreviations that are used in the report.

9. The ninth part of the report deals with the list of symbols. It contains a list of the symbols that are used in the report.

10. The tenth part of the report deals with the list of units. It contains a list of the units that are used in the report.

Table XI reveals that there is a difference between the sexes on their performance on the Time Concept Test, significant at the 3% level of confidence in favor of the male group. This suggests that sex is a factor having some influence on performance on the Time Concept Test in favor of males.

This evidence of significant sex difference contradicted the findings of Friedman and of Gilliland and Humphrey. It is felt that the results of the present study were affected by the uneven distribution of sexes between the various grade levels. Table III reveals that there were 100 boys in Grades IV, V, and VI, as against 60 girls in the same grades. In Grades II and III there were 35 boys and 53 girls. Table VIII shows that there was a steady increase in the pupils' scores on the Time Concept Test by grades as indicated by the mean scores. With such a distribution - that is, having more boys in the upper grades, it indicates that more boys got higher scores than girls on the Time Concept Test; and a lesser number of boys in the lower grades indicates that a lesser number of boys got lower scores. These affected the total mean scores for boys and girls, thus producing a significant sex difference in favor of the boys.

In any case, further investigation of the contradictory evidence may be one of the most fruitful areas, to achieve a clearer understanding of any sex difference in

the development of time concepts. The present evidence indicates that the factor of sex should be more rigorously controlled in studies purporting to investigate the relationships between time concepts and other variables.

In Table XII are shown results on the Time Concept Test for pupils grouped according to father's occupation. It will be recalled that the system used to classify occupations included five meaningful classifications plus one for those whose fathers were deceased or whose occupations were unknown.

Table XII

Data on the Time Concept Test Scores Grouped According to
Father's Occupation

Category	Frequency	Mean	Standard Deviation
no father	5	30.60	11.46
professional	82	32.83	9.80
semi-professional	44	34.23	8.21
skilled	82	33.85	7.99
semi-skilled	33	32.33	8.24
unskilled	2	16.50	4.95
Total	248		

Inspection of Table XII reveals that pupils under the "no father" category had the greatest variability with a

standard deviation of 11.46, and pupils with father's occupation under the unskilled category had the smallest variability with a standard deviation of 4.95. But the N or the number of cases in both groups were so small that their standard deviation are meaningless. It was decided, therefore, that these two categories be dropped in testing for the significance of the differences among the groups.

Table XIII

Summary of the Analysis of Variance of the Time Concept Test Scores Grouped According to Father's Occupation (not including the "no father" and "unskilled" categories)

Source of Variation	Sum Squares	df	Mean Squares	F	p
Between groups	110.95	3	36.98	.49	.70
Within groups	18032.91	237	76.09		
Total	18143.88	240			

Table XIII shows that there are no significant differences between the four groups : namely professional, semi-professional, skilled, and unskilled. This means that we cannot conclude that pupils from varying socio-economic levels would differ significantly on their performance on the Time Concept Test. This result does not support Hypothesis VII, but it seems to agree with those of other investigators, example Friedman who found a very low positive relationship between socio-economic status and time concepts.

1. 2



CHAPTER V

SUMMARY, CONCLUSIONS, AND EDUCATIONAL IMPLICATIONS

The purposes of the present study were to investigate the nature and development of time concepts in elementary school children, and to determine the relationship of development of time concepts to intelligence quotient, mental age, and chronological age. Also, the study aimed to determine any significant differences between the groups on the Time Concept Test when divided according to sex, grade placement, and socio-economic status. The study attempted to test the following hypotheses:

1. There is a gradual and steady growth in the formation of concepts of time in children with age.
2. There is a positive relationship between children's concepts of time and intelligence.
3. There is a positive relationship between children's concepts of time and mental age.
4. Time concepts of children are more closely related to intelligence and mental age than to chronological age.
5. There is a significant difference in the time concepts of pupils from grades two through six.
6. There is no significant difference between the sexes in their concepts of time.

7. There is a significant difference in the time concepts of pupils from varying socio-economic levels.

The sample for the study was composed of 135 boys and 113 girls, or a total of 248 pupils from grades two through six.

A preliminary form of the Time Concept Test was constructed and administered to a small sample of pupils from grades two through six. After the test was tried and scored, an item analysis was done and the test was revised. Then a larger sample was chosen and the Time Concept Test in its revised form was administered. The Otis Quick-Scoring Mental Ability Tests - Alpha Short Form and Beta Form CM were also administered to obtain measures of the pupils' intelligence quotients and mental ages. Also, data on chronological age, sex, grade placement, and socio-economic status were collected for all the subjects.

Correlation coefficients between Time Concept Test scores and the Otis IQ and MA scores and chronological ages were computed to determine the relationship of time concepts to intelligence quotient, mental age, and chronological age. Analysis of variance of grade placement, sex, and socio-economic status were made on the Time Concept Test scores to determine any significant differences between the various groups.

Analysis of results revealed the following:

1. The data supported the hypothesis that there is a

gradual and steady growth in the formation of concepts of time in children with age.

2. The hypothesis that a positive relationship between time concepts and intelligence quotient would be found was sustained.
3. The hypothesis that there is a positive relationship between time concepts and mental age was also statistically supported.
4. It was hypothesized that time concepts of children are more closely related to intelligence quotient and mental age than to chronological age. Results indicated that time concepts are more highly related to mental age than to chronological age, but did not show that time concepts are more highly related to intelligence quotient than to chronological age.
5. The hypothesis that there is a significant difference between the performances of pupils in grades two through six on the Time Concept Test was supported by the data.
6. Results showed that there is a significant difference between the boys and the girls on their performance on the Time Concept Test, in favor of the boys. This is not in the direction hypothesized.
7. It was hypothesized that there is a significant difference in the time concepts of pupils from

varying socio-economic levels. The data did not support this hypothesis. Results showed that there is no significant difference between the performances of pupils from the various groups - the professional, the semi-professional, the skilled and the semi-skilled groups, on the Time Concept Test.

Educational Implications

The results of the study posed several implications for the provision of educational experiences of elementary school children in their need to deal with the concepts of time.

Evidence show that although intelligence quotient may be a factor to a slight degree, in the formation of the concepts of time, mental age and chronological age are better predictors. That is, the development of the concepts of time seems to be more a function of growth and maturation than of brightness, although intelligence quotient as a factor cannot be entirely ruled out. Therefore, if children's concepts of time are acquired largely through maturation, it is important for teachers and curriculum makers to defer systematic instruction of certain time concepts until the pupils have reached the level of maturity required to understand such concepts.

Evidence from this study supports the idea that pupils increase their knowledge and understanding of the concepts

of time steadily and continuously from grade to grade. This result implies that the grade placement of time expressions should be considered in curriculum construction. Teachers should provide the necessary learning situations in order that pupils may acquire increasingly mature concepts of time.

It was found in the present study that although pupils could tell time by the clock, writing the time as shown by the clock was another thing. When asked about the test questions after they took the Time Concept Test, a great number of pupils expressed the inability to match the written time with the time shown on the clocks, particularly those times that involved a few minutes before the hour. For example: pupils had a difficult time matching 7:50 to the clock which told that specific time. By reading the time on the clock, they knew that it was 10 minutes before 8 o'clock but they did not know how this was written. This shows that this aspect of the concept of time is learned orally at first, and then the writing of it comes later. Even though the child cannot write the time as shown by the clock, it does not necessarily mean that he does not understand it.

The study also pose implications for parents, teachers, and all other adults who come in contact with children. With the experience gained by the investigator through the course of the study, it was noted that if adults will only try to be more careful about their usage of the different time ex-

pressions, children will benefit greatly from them. That is, adults should try to phrase the time expressions they use in such a way that children will have a grasp of what was said. For example: the use of the phrase "in a minute", by adults seem to be too lax. Usually what is meant by such a time expression is not the exact minute or sixty seconds. So, if adults will rephrase their statements and say what they really mean, such as "after I get done with this", instead of using a definite time expression, they may help children acquire better understanding of the concept of time.

Contributions of research

The present study has further confirmed some of the previous findings on the nature and development of time concepts in children. It has presented evidence on the positive relationship between time concepts and intelligence quotient, mental age, and chronological age. It also presented evidence on grade placement as a significant factor in the development of time concepts.

Basically, the present study has contributed to the field a Time Concept Test, an improvement in certain respects over the ones used in previous studies. It is felt that in order to interpret test results properly, more information beyond directions for administering and scoring the test must be given. Most of the previous studies did not

report reliability and validity of the tests used. The only investigator who reported evidence on the reliability of the time concept test used was Friedman (7, 8), who reported a .85 reliability coefficient (test-retest) for his high school test. He did not report any evidence of validity. Systematic data on both reliability and validity were reported for the present test. In both respects it proved to be generally quite acceptable.

Also, the present Time Concept Test had been constructed according to accepted principles of planning, constructing, and evaluating such instruments. It is an objective test which could be easily administered and scored, and the results could be easily interpreted in terms of raw scores. Most of the Time Concept Test used in the previous studies were not as objective as they should have been which posed problems in scoring and interpreting results for anyone desiring to use them.

Suggestions for improving the present study

As a check on the results and conclusions offered above, it is suggested for future studies purporting to investigate the relationship between time concepts and certain other variables, where possible, to have equal number of subjects between the sexes in every grade level. The findings of the present study indicated a significant difference between the performances of the boys and the girls

on the Time Concept Test. In the present study this seems to be a result of the preponderance of boys at the upper grade levels and the preponderance of girls at the lower grade levels.

It is also suggested, that more information other than amount of schooling the fathers have had, and the occupation as such, be collected for future studies about socio-economic levels, so as to be able to do a more thorough classification of the various occupations.

Also, it is suggested that the sample population be drawn from a locality not within the immediate vicinity of a university where a great number of the paternal occupations fall in the professional category. In the present study there were only two pupils that were classified under the unskilled category. If there were enough pupils to warrant the inclusion of the unskilled category, it seems possible that results could have been different from what was presently obtained. It was also found in the present study that the semi-professional and the skilled groups had higher mean scores than the professional group which was contrary to what had been anticipated. Further investigation in this area is suggested to check on this result of the study.

The difficulty level of the present Time Concept Test was found to be inadequate for the bright pupils and for grades five and six. To improve the present test, it is suggested that more difficult items be added; or maybe two

forms of the test be used - one for grades two and three, and one for grades four, five, and six, with increased difficulty level for the upper grades.

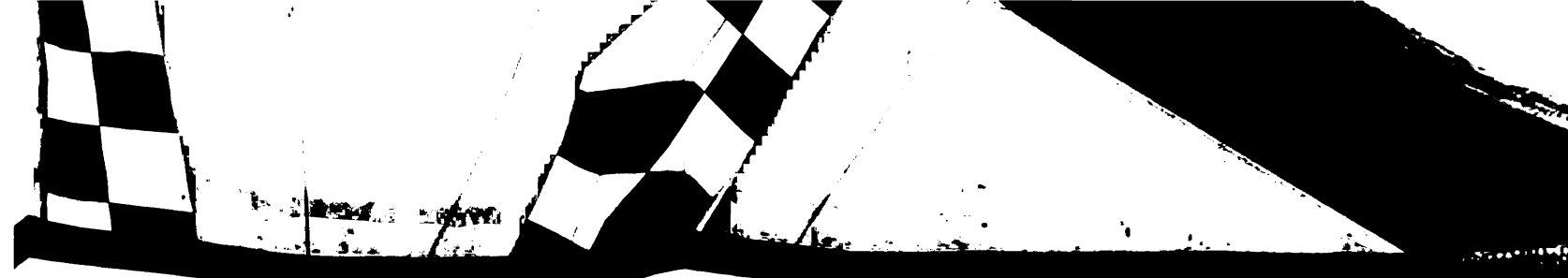
Recommendations for future studies

In future studies about concepts of time, it seems most interesting to know the relationship of good knowledge of number meanings to development of time concepts; and also, the relationship of the development of time concepts to pupil adjustment.

There continues to be a place for tests in evaluating pupil progress and development but in a new context - to ascertain whether or not children are acquiring a stock of factual information upon which to base their actions and thoughts that give them perspective to the highly complex twentieth-century living. We need to see more of such tests put to use in future studies; and better still, it would be most interesting to see the development of newer techniques and methods for assessing child growth and development.

APPENDIX A

THE PRELIMINARY FORM OF THE TIME CONCEPT TEST



Name _____

Grade _____

School _____

Date of birth _____

Sex _____

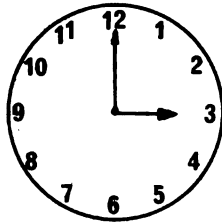
Father's occupation _____

Mother's occupation _____

I. Matching

Find the time on the left hand side that tells the time on each clock. Write one letter only after each number under the clocks.

For example:

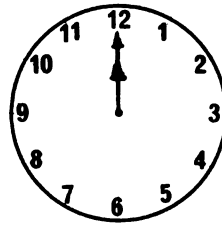


0. E

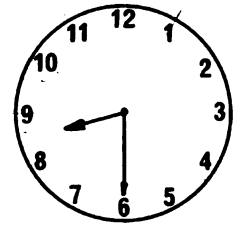
Here E has been marked
because the clock shows
3:00 o'clock.

Group A

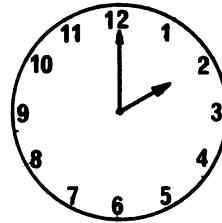
- A. 11:20
- B. 6:30
- C. 3:15
- D. 6:00
- E. 3:00
- F. 12:15
- G. 3:30
- H. 12:00
- I. 2:00
- J. 10:30
- K. 3:45
- L. 9:15
- M. 8:30



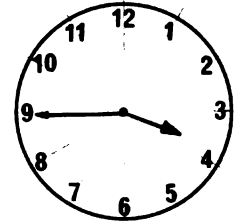
1. _____



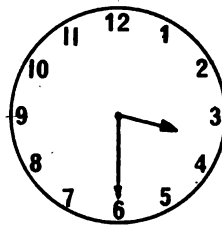
2. _____



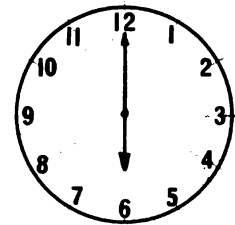
3. _____



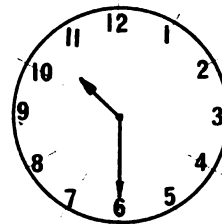
4. _____



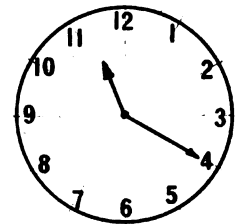
5. _____



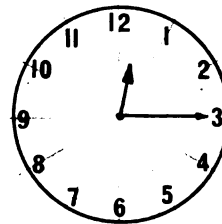
6. _____



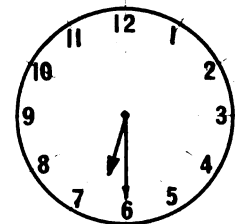
7. _____



8. _____



9. _____



10. _____

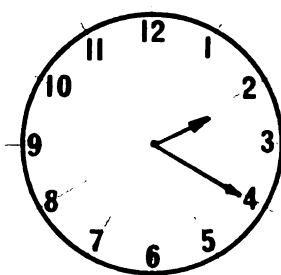
I. Methods

Find the side of the square.

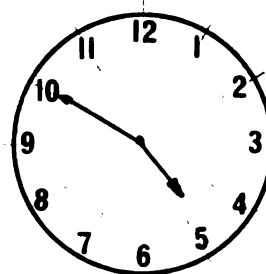
Let the side of the square be x .

I. Matching (continued)Group B

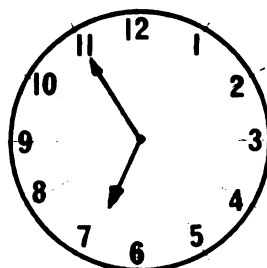
- A. 9:45
- B. 10:08
- C. 3:40
- D. 2:20
- E. 11:57
- F. 11:05
- G. 6:55
- H. 5:28
- I. 1:10
- J. 4:50
- K. 7:40
- L. 1:03



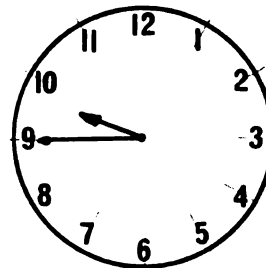
1. _____



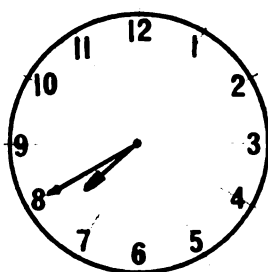
2. _____



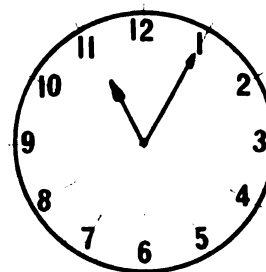
3. _____



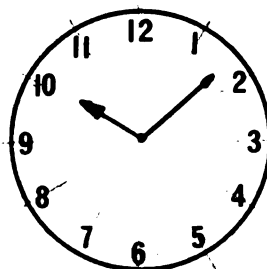
4. _____



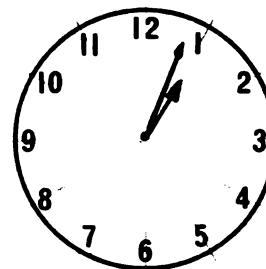
5. _____



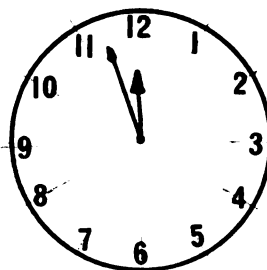
6. _____



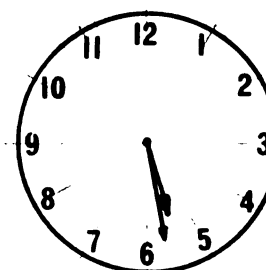
7. _____



8. _____



9. _____



10. _____

17

II. Yes or No.

Put a cross (+) before each statement that is right, and put a circle (0) before each statement that is wrong.

- ___ 1. The sun rises in the morning.
- ___ 2. There are five days in a week.
- ___ 3. Thanksgiving Day comes in the Fall.
- ___ 4. There are twelve hours in a day.
- ___ 5. Christmas eve is on December 24.
- ___ 6. There are twelve months in a year.
- ___ 7. Only five of the months in a year have exactly thirty days.
- ___ 8. The month of July follows the month of June.
- ___ 9. February gets one day more every leap year.
- ___ 10. Leap year comes every other year.
- ___ 11. The year 1964 is a leap year.
- ___ 12. 12:00 P.M. is midnight, and 12:00 A.M. is noon.
- ___ 13. The year 1965 is in the nineteenth century.
- ___ 14. The year 4 B.C. comes after the year 2 A.D.
- ___ 15. A minute is longer than a second.
- ___ 16. The long hand of the clock is called the hour hand.
- ___ 17. Two decades is equal to a score of years.
- ___ 18. There are ten years in a century.
- ___ 19. History is always in the past.
- ___ 20. People all over the world experience the four seasons of the year.

Pretend that today is Monday, March 15, 1965. Based on this date, are the following statements right or wrong?

- ___ 21. Today would be a national holiday in the United States of America.

OK to say .II

First part of the book is a list of the names of the people who were in the country in 1861.

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- ___ 22. Tomorrow would be Saturday.
- ___ 23. Easter Sunday would be two months away.
- ___ 24. Hallows'en would have been last month.
- ___ 25. Yesterday would have been Sunday.
- ___ 26. The day after tomorrow would be Wednesday.
- ___ 27. The year 1865 would have been about a century ago.
- ___ 28. The year 1954 would have been more than a decade ago.
- ___ 29. Next Monday would be the end of the month.
- ___ 30. Christmas would be next month.

III. Multiple Choice :: Opposites

Choose the lettered word which tells the opposite of the given word. Write only the letter on the space provided.

For example:

- | | | | | |
|--------------------|------------|------------|-------------|-------------|
| ___ 0. night - | A. during | B. morning | C. evening | D. day |
| ___ 1. old - | A. ago | B. once | C. young | D. ever |
| ___ 2. quick - | A. sudden | B. around | C. present | D. slow |
| ___ 3. first - | A. last | B. again | C. follow | D. long |
| ___ 4. before - | A. while | B. until | C. after | D. beyond |
| ___ 5. early - | A. prompt | B. late | C. former | D. soon |
| ___ 6. never - | A. latter | B. always | C. frequent | D. sometime |
| ___ 7. brief - | A. became | B. long | C. began | D. during |
| ___ 8. new - | A. old | B. since | C. now | D. still |
| ___ 9. modern - | A. current | B. instant | C. recent | D. ancient |
| ___ 10. frequent - | A. seldom | B. never | C. ere | D. coming |
| ___ 11. former - | A. forgot | B. latter | C. future | D. ever |
| ___ 12. end - | A. last | B. begin | C. continue | D. follow |

4

4

22. Tomorrow would be Saturday.

IV. Analogies.

Choose the word which will correctly fill the blank in the sentence. Write only the letter on the space before the sentence.

For example:

- B 0. Showers is to Spring as snow is to ____.
A. cold B. Winter C. snowman D. ice
1. Winter is to cold as summer is to ____.
A. flowers B. warm C. rain D. sun
2. Summer is to swimming as winter is to ____.
A. skiing B. windy C. snowing D. cold
3. Spring is to Summer as Fall is to ____.
A. leaves B. cold C. Autumn D. Winter
4. Sandbox is to summer as snowman is to ____.
A. Winter B. snow C. ice D. frost
5. Sun is to day as moon is to ____.
A. night B. stars C. planet D. round
6. Sleep is to night as play is to ____.
A. games B. afternoon C. day D. early
7. Day is to night as light is to ____.
A. dark B. sleep C. supper D. late
8. Breakfast is to morning as lunch is to ____.
A. evening B. noon C. night D. supper
9. Night is to day as midnight is to ____.
A. morning B. noon C. afternoon D. bright

- ___ 10. Sunrise is to dawn as sunset is to ____.
A. west B. noon C. dusk D. dark
- ___ 11. Days is to month as minutes is to ____.
A. hour B. time C. clock D. seconds
- ___ 12. Seconds is to minute as months is to ____.
A. night B. day C. hour D. year
- ___ 13. Monday is to Tuesday as Saturday is to ____.
A. Wednesday B. Friday C. Thursday D. Sunday
- ___ 14. January is to February as April is to ____.
A. March B. May C. June D. July
- ___ 15. June is to July as September is to ____.
A. August B. November C. April D. February
- ___ 16. Future is to tomorrow as past is to ____.
A. morning B. today C. afternoon D. yesterday
- ___ 17. Present is to past as now is to ____.
A. must B. will be C. then D. never
- ___ 18. Seven is to week as fourteen is to ____.
A. fortnight B. month C. bi-monthly D. year
- ___ 19. Ten is to twenty as decade is to ____.
A. century B. score C. mid-century D. eternity
- ___ 20. Quarter-hour is to quarter-century as fifteen minutes is to ____.
A. 15 years B. 25 years C. 50 years D. 20 years

_____ to _____ is to have an answer in to _____

V. In each group, put a cross (+) on the line before the word or group of words that tells the shortest period of time, and put a circle (0) before the word or group of words that tells the longest period of time.

Example: + day

 month

0 year

1. hour

 minute

 second

6. decade

 quarter-century

 a score of years

11. 16 minutes

 quarter-hour

 70 seconds

2. month

 fortnight

 week

7. 30 minutes

 40 seconds

 one hour

12. 5 weeks

 15 days

 one month

3. century

 year

 eternity

8. bi-monthly

 weekly

 bi-weekly

13. 5 months

 half a year

 20 weeks

4. annual

 monthly

 semi-annual

9. half-hour

 quarter-hour

 20 minutes

14. 30 years

 2 decades

 2 centuries

5. 3 weeks

 23 days

 2 months

10. 3 decades

 half-century

 2 scores of years

15. 3 centuries

 5 scores of years

 8 decades

APPENDIX B

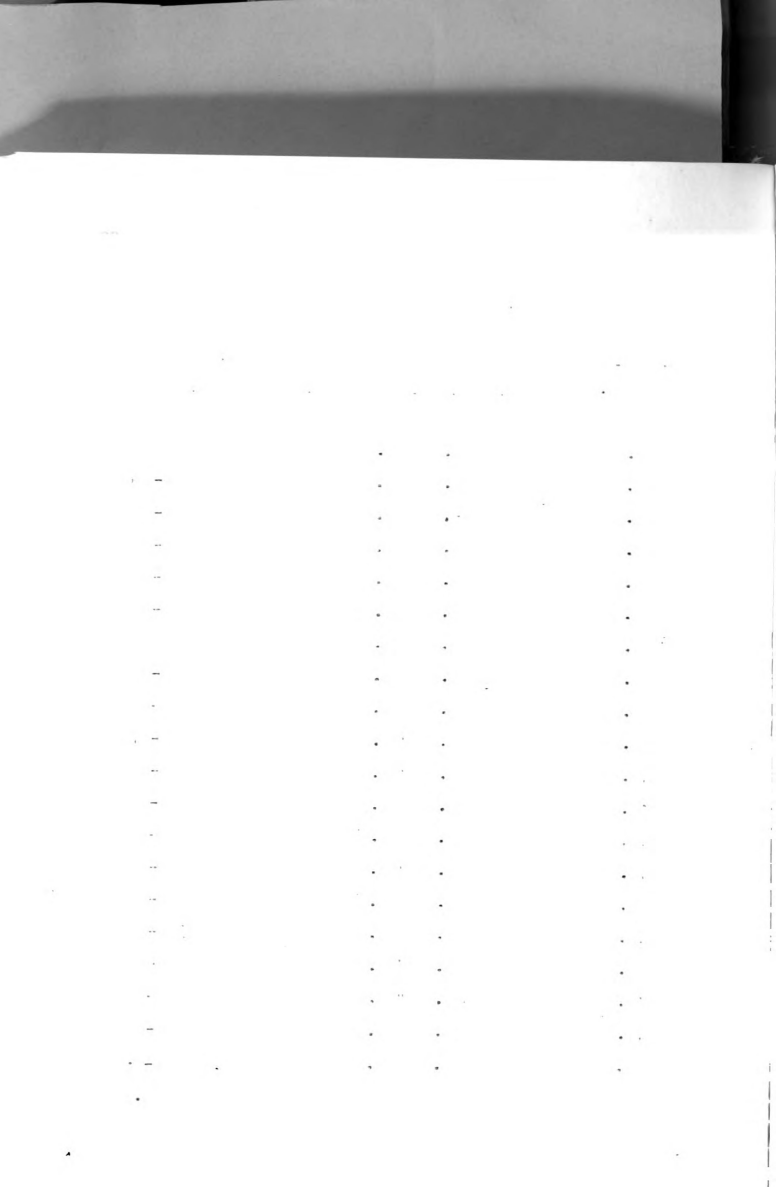
RANGES OF THE DISCRIMINATION INDEXES AND DIFFICULTY VALUES
FOR EACH ITEM IN THE PRELIMINARY FORM OF THE TIME CONCEPT TEST

APPENDIX B

Ranges of the discrimination indexes and difficulty values for each item in the preliminary form of the Time Concept Test

<u>Item No.</u>	<u>Discrimination Index</u>	<u>Difficulty Value</u>
<u>Part I</u>		
1.	-.20 to .23	73 - 100
2.	-.07 " .16	73 - 96
3.	-.20 " .54	73 - 100
*4.	.07 " .54	29 - 72
*5.	.08 " .61	50 - 96
6.	.00 " .54	66 - 96
7.	.00 " .21	73 - 96
8.	.00 " .54	66 - 97
*9.	.08 " .61	38 - 96
10.	.00 " .69	44 - 100
11.	.07 " .61	44 - 96
*12.	.27 " .61	20 - 77
*13.	.27 " .64	24 - 73
*14.	.31 " .69	43 - 92
*15.	.31 " .54	23 - 81
*16.	.31 " .54	30 - 85
17.	.00 " .54	33 - 86
18.	.08 " .39	26 - 84
*19.	.33 " .75	23 - 79
*20.	.15 " .40	40 - 92

*Items retained in final form of the Time Concept Test.



Appendix B (continued)

Part II

1.	-.15 to .54	73 - 100
2.	.07 " .21	64 - 96
3.	.00 " .29	65 - 92
*4.	.07 " .67	54 - 89
5.	-.16 " .47	30 - 85
*6.	.00 " .67	34 - 96
*7.	.23 " .40	20 - 72
*8.	.07 " .33	30 - 86
9.	.00 " .29	26 - 62
*10.	.08 " .64	20 - 65
*11.	-.15 " .27	20 - 69
12.	-.23 " .23	12 - 27
13.	-.39 " .33	17 - 83
*14.	.15 " .33	17 - 72
*15.	.23 " .47	24 - 86
*16.	.34 " .39	20 - 72
17.	-.15 " .23	10 - 71
18.	.00 " .36	17 - 76
*19.	.07 " .36	14 - 61
20.	-.23 " .20	14 - 43
21.	-.08 " .13	7 - 68
*22.	.07 " .43	30 - 61
23.	-.15 " .46	34 - 82
*24.	.07 " .69	27 - 97
*25.	.07 " .61	3 - 61

*Items retained in final form of the Time Concept Test.

Appendix B (continued)

26.	.00 "	.46	13 - 61
*27.	.15 "	.61	27 - 77
*28.	.23 "	.23	13 - 57
29.	.08 "	.40	33 - 88
30.	.00 "	.54	13 - 97

Part III

*1.	.00 "	.54	73 - 100
*2.	.08 "	.46	57 - 96
3.	.08 "	.23	70 - 100
4.	.00 "	.39	50 - 100
5.	.00 "	.46	40 - 100
6.	.08 "	.43	23 - 80
*7.	.20 "	.46	10 - 57
*8.	.00 "	.23	63 - 100
9.	-.20 "	.21	10 - 75
10.	-.07 "	.21	19 - 47
11.	.07 "	.15	16 - 29
*12.	.20 "	.54	17 - 86

Part IV

*1.	.00 "	.39	30 - 90
*2.	.13 "	.61	20 - 86
3.	-.13 "	.61	7 - 61
*4.	.00 "	.16	24 - 92
*5.	.08 "	.53	33 - 93

*Items retained in final form of the Time Concept Test.

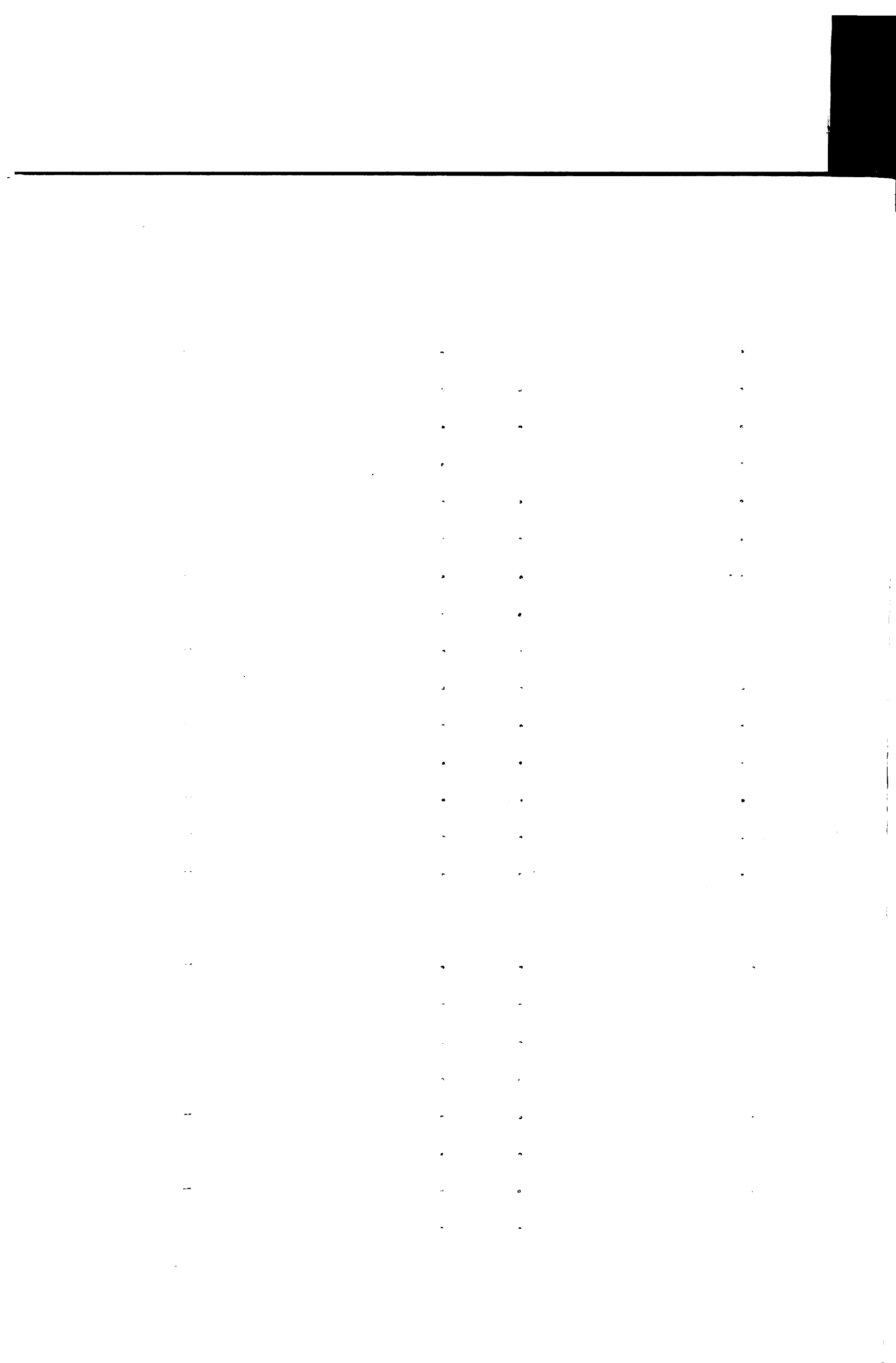
Appendix B (continued)

6.	.00 "	.16	24 - 92
*7.	.27 "	.36	27 - 85
*8.	.15 "	.33	23 - 93
9.	-.15 "	.43	3 - 29
10.	.07 "	.86	3 - 53
*11.	.00 "	.46	0 - 72
*12..	.07 "	.46	3 - 82
13.	.13 "	.31	13 - 92
*14.	.08 "	.46	10 - 80
15.	-.15 "	.20	10 - 31
*16.	.07 "	.31	3 - 85
17.	-.16 "	.27	17 - 57
18.	-.15 "	.23	0 - 27
19.	-.15 "	.21	7 - 39
20.	-.15 "	.16	0 - 14

Part V

*1.	.08 "	.85	33 - 85
	.08 "	.50	27 - 76
*2	.15 "	.69	31 - 73
	.23 "	.31	27 - 54
*3.	.07 "	.15	3 - 33
	.13 "	.54	13 - 57
4.	.07 "	.15	3 - 33
	.07 "	.21	3 - 31

*Items retained in final form of the Time Concept Test.

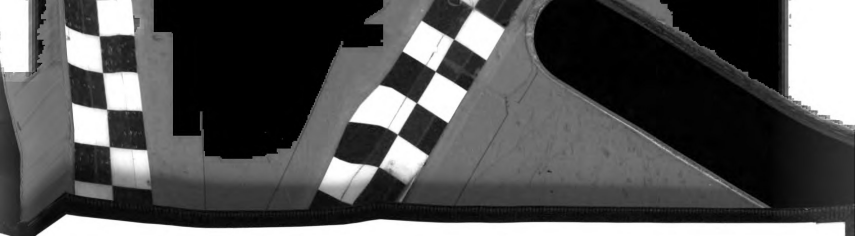


Appendix B (continued)

*5.	.23 "	.61	17 - 54
	.33 "	.54	30 - 72
6.	-.08 "	.23	19 - 40
	-.07 "	.39	10 - 27
*7.	.16 "	.69	33 - 43
	.23 "	.47	32 - 61
8.	-.07 "	.39	23 - 62
	.00 "	.47	13 - 27
*9.	.23 "	.43	23 - 70
	.00 "	.21	7 - 65
10.	.08 "	.23	4 - 29
	.15 "	.39	14 - 29
11.	-.08 "	.31	7 - 25
	-.07 "	.40	20 - 39
12.	.08 "	.46	10 - 43
	.00 "	.54	15 - 58
13.	.15 "	.54	17 - 54
	.08 "	.46	17 - 46
14.	-.15 "	.61	8 - 38
	-.08 "	.40	20 - 58
15.	.07 "	.50	3 - 46
"	.00 "	.15	7 - 31

*Items retained in final form of Time Concept Test.

APPENDIX C
FINAL FORM OF THE TIME CONCEPT TEST



Name _____

Grade _____

School _____

Date of birth _____

Sex _____

Father's occupation _____

Mother's occupation _____

I. Matching

Find the time on the left hand side that tells the time on each clock. Write one letter only after each number under the clocks.

For example:



O. E

Here E has been marked
because the clock shows
3:00 o'clock.

A. 7:40

B. 4:55

C. 6:20

D. 11:57

E. 3:00

F. 1:55

G. 3:45

H. 11:35

I. 9:45

J. 3:30

K. 10:25

L. 11:05

M. 6:50

N. 12:15

O. 5:28



1. _____



2. _____



3. _____



4. _____



5. _____



6. _____



7. _____



8. _____



9. _____



10. _____

II. Yes or No.

Put a cross (+) before each statement that is right, and put a circle (0) before each statement that is wrong.

For example:

+ 0. Wednesday comes after Tuesday.

0 0. Thursday comes after Friday.

 1. There are twelve hours in a day.

 2. There are twelve months in a year.

 3. Only five of the months in a year have exactly thirty days.

 4. The month of July follows the month of June.

 5. Leap year comes every other year.

 6. The year 1964 is a leap year.

 7. The year 4 B.C. comes after the year 2 A.D.

 8. A minute is longer than a second.

 9. The long hand of the clock is called the hour hand.

 10. History is always in the past.

Pretend that today is Monday, March 15, 1965. Based on this date, are the following statements right or wrong?

 11. Tomorrow would be Saturday.

 12. Hallowe'en would have been last month.

 13. Yesterday would have been Sunday.

 14. The year 1865 would have been about a century ago.

 15. The year 1954 would have been more than a decade ago.

III. Multiple Choice : Opposites

Choose the lettered word which tells the opposite of the given word. Write only the letter on the space provided.

For example:

- | | | | | |
|----------------|-----------|------------|-------------|-------------|
| ___ 0. night - | A. during | B. morning | C. day | D. evening |
| ___ 1. old - | A. ago | B. once | C. ever | D. young |
| ___ 2. quick - | A. slow | B. around | C. present | D. sudden |
| ___ 3. brief - | A. became | B. long | C. began | D. sometime |
| ___ 4. new - | A. now | B. since | C. old | D. still |
| ___ 5. end - | A. last | B. begin | C. continue | D. follow |

IV. In each group, put a cross (+) on the line before the word or group of words that tells the shortest period of time, and put a circle (0) before the word or group of words that tells the longest period of time.

For example: + day
 ___ month
 ___ 0 year

- | | | |
|---------------|----------------|-------------------|
| 1. ___ hour | 2. ___ century | 3. ___ 30 minutes |
| ___ minute | ___ year | ___ 40 seconds |
| ___ second | ___ eternity | ___ one hour |
| 4. ___ month | 5. ___ 3 weeks | 6. ___ half-hour |
| ___ fortnight | ___ 23 days | ___ quarter-hour |
| ___ week | ___ 2 months | ___ 20 minutes |

V. Analogies

Choose the word which will correctly fill the blank in the sentence. Write only the letter on the space before the sentence.

For example:

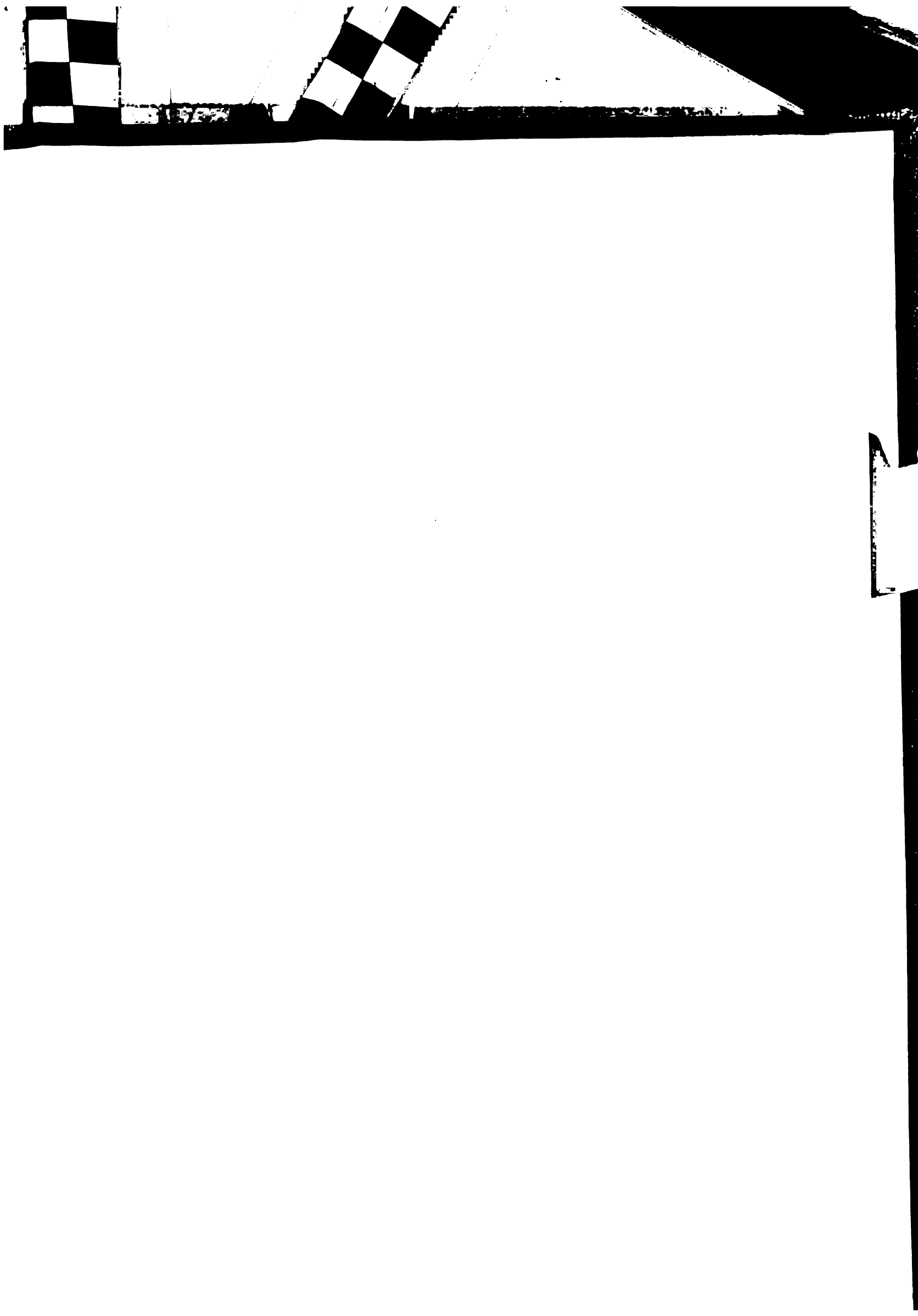
- B 0. Showers is to Spring as snow is to ____.
A. cold B. Winter C. snowman D. ice
1. Winter is to cold as summer is to ____.
A. flowers B. warm C. rain D. sun
2. Summer is to swimming as Winter is to ____.
A. skiing B. windy C. snowing D. cold
3. Sandbox is to Summer as snowman is to ____.
A. Winter B. snow C. ice D. frost
4. Sun is to day as moon is to ____.
A. night B. stars C. planet D. round
5. Day is to night as light is to ____.
A. dark B. sleep C. supper D. late
6. Breakfast is to morning as lunch is to ____.
A. evening B. noon C. night D. supper
7. Days is to month as minutes is to ____.
A. hour B. time C. clock D. seconds
8. Seconds is to minutes as months is to ____.
A. night B. day C. hour D. year
9. January is to February as April is to ____.
A. March B. May C. June D. July
10. Future is to tomorrow as past is to ____.
A. morning B. today C. afternoon D. yesterday

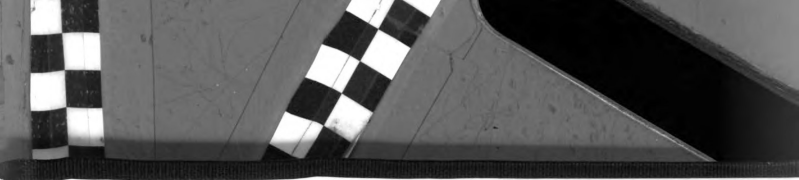
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