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An investigation of time relationship understandings in grades four through eight

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AN INVESTIGATION OF TIME RELATIONSHIP UNDERSTANDINGS
IN GRADES FOUR THROUGH EIGHT

Submitted by

C. L. John Legere

(B. S. in Ed., Fitchburg State Teachers College, 1951)

(Ed. M., Fitchburg State Teachers College, 1956)

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the Degree of Doctor of Education

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First Reader: W. Linwood Chase

W. Linwood Chase

Professor of Education

Second Reader: John G. Read

John G. Read

Professor of Education

Third Reader: Gilbert M. Wilson

Gilbert M. Wilson

Associate Professor of Education

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CHAPTER I

THE PROBLEM

1. Purpose of the Study

It was the purpose of this study to construct and evaluate an instrument to measure understandings and abilities related to time concepts and to use this instrument to investigate the time relationship understandings of children in grades four through eight.

This instrument relates, or equates, the understanding of time to curriculum problems, specifically in the determination of individual readiness, level of difficulty, and degree of mastery as a factor in social studies learning.

2. Background of the Problem

There are many factors which affect a child's learning. There are many kinds of learning experiences within which a child must operate. Many of these learning experiences involve the creation of developmental patterns of thinking and acting which depend upon previous experiences and will set the foundation for future experience. No experience, or learning, consists of a skill or operation which is composed of one factor

alone. Knowledge of one factor within a learning experience will, however, allow the teacher to be a better guide for pupil experience.

Among the multi-factored learning areas in our schools is social studies. Time understanding is among the many factors which make up social studies knowledge. It exists in the form of a conceptual ability to differentiate a factor, and to attach significance to this factor. This ability is not always used, or developed in our schools: "Even today, when there is so much improved historical teaching, history to many students remains a mechanical series of lifeless dates and inert events."^{1/} The flow of human history and the inter-relationships of the acts of men during interdependent periods of time is the basis for social studies knowledge. A prime factor in the recognition of this pattern of man's history is the understanding of time.

3. The Need for the Study

To be effective, the teacher must have an indication of the child's potential, his achievement, and his retentive use and transfer of learning. The social studies teacher must have this knowledge of time related understandings so that he will

^{1/}C. W. DeKiewiet, "The Meaning of Historical Time," Social Education (January 1945), 9:13-15, p. 13.

know when and where to expect dependent conceptualizations to take place. The methodologically oriented researcher must know when children can learn concepts so that he might design ways in which the teacher can develop such learnings. This has been pointed out by Pistor ^{1/} in the following statement:

"An adequate understanding of the development of children's time concepts is necessary for those who plan programs of social study, irrespective of the general type of curriculum organization."

Knowledge of these time understanding factors must be achieved through the research, construction, and use of an evaluation system. This system must be designed to locate and rank student understanding status in terms of time relationships.

There are no current instruments to insure validity when measuring time concepts and abilities in children of elementary and secondary school age: "We need more refined techniques for measuring both time and place sense and for charting the course of their development in children." ^{2/} Because of the findings of

^{1/}Frederick Pistor, "Measuring the Time Concepts of Children," Journal of Educational Research (December 1939), 33:293-300, p. 293.

^{2/}National Council for the Social Studies, Improving the Teaching of World History, Twentieth Yearbook, 1949, Chapter XIII, The Council, Washington, D.C., p. 116. (See Flickinger and Rehage)

previous researchers, mainly Pistor^{1/} and Friedman^{2/} there has been a tendency to delay the teaching of social studies concepts thought to contain reference, or dependence upon time understandings. There is, then, a need for an instrument which will render time factor data to serve as a basis for judgements relative to the content of the curriculum, the readiness of the learner, or the achievement status of the learner.

The importance of information relative to an individual's understanding of these time concepts and principles is emphasized when we consider that they are a base for social studies knowledge and the implication of these knowledges in the sweep of human events.

"While mathematics, much of science, and large portions of other fields operate independently of time and space, the materials of the social studies depend upon and involve time and space. The significance of persons, events, inventions, trends, and movements depends upon their being located in both time and place.

This condition does not mean that these two factors must continually be stated with respect to every particle of content; it does mean that the significance of realities in the social studies depends upon the setting and time sequence. They must be implicit or explicit in studying all social materials."^{3/}

^{1/}Frederick Pistor, "How Time Concepts are Acquired by Children," Educational Method, (November 1940), 20:107-112.

^{2/}Kopple C. Friedman, The Growth of Time Concepts, Unpublished Ph.D. Dissertation, University of Minnesota, 1943.

^{3/}Edgar B. Wesley, and Mary A. Adams, Teaching Social Studies in Elementary Schools, D. C. Heath Company, Boston, 1952, p. 103.

4. Hypotheses Tested

As stated earlier in this chapter, there is a definite need for information relating or equating the understanding of time to curriculum problems, individual readiness, level of learning, and retention difficulty with emphasis on the effect which mastery has on social studies learning.

The suggested solution to a part of the problem is the construction and evaluation of a test which would provide the information outlined above. The manner of problem solution is dependent upon the investigation of these basic hypotheses. The basic hypotheses, which served as a base for the research were:

1. Time relationships understanding is a tri-factored, (associative, spatial, mathematical) element displaying parallel and inter-related growth during the maturation of the individual.
2. Children display a higher degree of sophistication in this time understanding, than previous research indicates.
3. Time relationship measurement may be achieved as a unique and separate measure.

5. Theoretical Orientation

Definitions.-- For the purpose of this study, the following basic definitions were made:

1. Time relationships.-- Those relationships or connections which exist between individuals, events, or places and are caused by their relative position in time. These relationships exist because of the chain-like structure of historical sequence, and the overtones of the effect upon history.
2. Time conceptualizations.-- Those conceptual structures or understandings which allow an individual to understand time and time relationships. This framework of understanding permits the recognition of elements and systems of historical and social development as a part of a real system, not as isolated occurrences.

These definitions are related to those understandings which allow the individual to categorize or order events, both immediate and distant in terms of an associative manner, a spatial manner, or in a mathematical manner.

^{1/}
Wesley and Adams define these bases in the following manner:

^{1/}Wesley and Adams, op. cit., p. 303.

1. Associative basis.-- The associative basis has comparison uppermost, e.g., Washington cut down a tree WHEN he was a boy, etc.; this basis can finally bring a sense of chronology, but only with great effort. The basis has no logic, no system, nor does it erect categories; it is then, subordinate to events.
2. Spatial basis.-- The spatial basis of time understanding consists of the envisioning of a week as a row of seven days, the hour as a circle of sixty minutes, etc. It concerns distance on the face of the clock, the sun's distance from the horizon determining time past or time left. The time line capitalizes on this.
3. Mathematical basis.-- The mathematical basis of time understanding has to do with the sense of quantity. People using this as a base have a mental image of a number in relation to time, e.g., 1920 comes before 1930, 1921, 1922, etc. To people with a good mathematical sense of time, the dates before Christ are negative numbers.

Assumptions.-- It is assumed that time understanding ability is developmental in nature, i.e., potentially present in very young children and developed through childhood to adulthood.

At each stage of development the ability is present in varying degrees with different individuals acquiring and maintaining it to different levels of effectiveness and proficiency.

In terms of the types of bases used for understanding, there is a three pronged conical growth, i.e., vertical development with corresponding and proportional horizontal growth and enrichment. Figure 1 develops a graphic demonstration of this pattern. This concept is mentioned to clarify any misunderstanding which may result from the consideration that a spatial base of time understanding is a function of the mathematical, etc. They may all appear in the rudimentary stage of development, within the range of other individual abilities present, and although appearing and developing in a seemingly independent manner, may be interdependent and extra-dependent upon other growth factors. The manner in which these bases are utilized and linked with other factors within the individual will indicate growth in conceptual understanding of a time relationship. There is no reference made to this development in the literature.

Theoretical development of time concepts.-- A system for showing the development of time understanding was constructed to clarify this test construction process. This framework is a synthesis of, and extension of, systems reported in the liter-

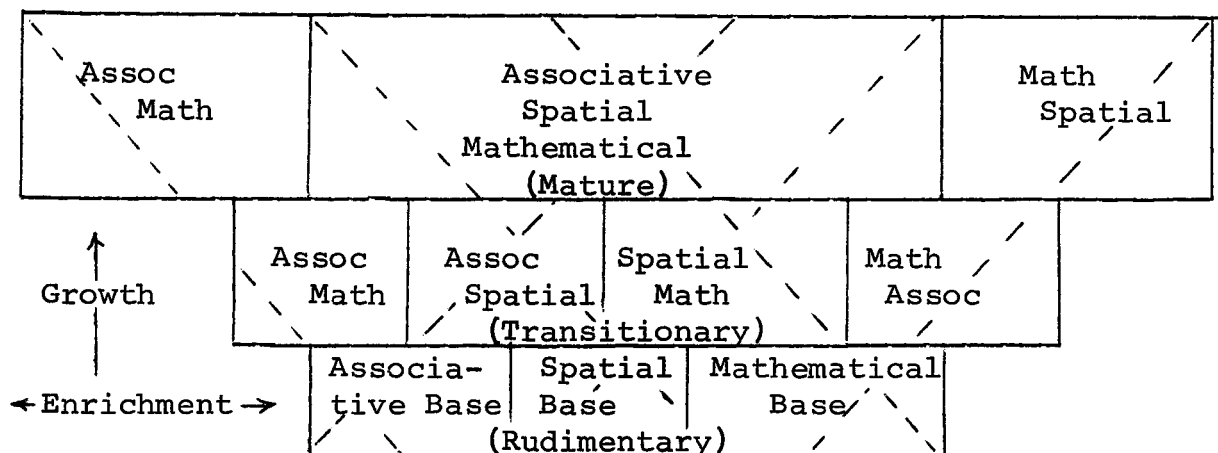


Figure 1. Theoretical Growth and Combination of Time Understandings

ature and does not appear in this form in other documents.

1. Rudimentary.-- Time concepts which are at the base of relationship frameworks and allow an understanding of what has just happened, what is happening, and what will happen in the immediate future.
 - a. Immediate in scope.-- This type of time understanding is evidenced mostly by vocabulary in terms of concrete time terms learned for other than social studies purposes.
 - b. General in scope.-- These understandings are more inclusive than the immediate type but are still limited to the experience of the individual, e.g., what I did last week, am doing now, and will do

next summer.

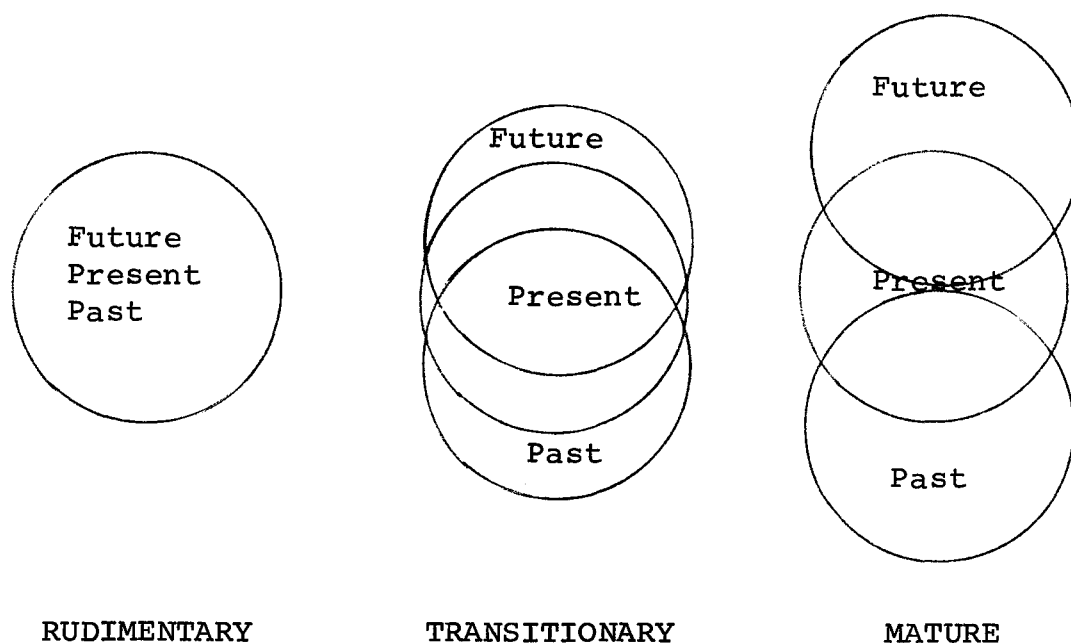
2. Transitionalary.-- Time concepts which are formed and are forming in individuals which assist in an understanding of what is happening, what has happened, and what will happen within the framework of recognizable and connectable surroundings of the individual.
 - a. Personal in scope.-- This type of transitionalary understanding is contained by personal involvement in the past or future, e.g., family history, community history, family/community activities, and family/community aspirations.
 - b. Academic in scope.-- This type of transitionalary understanding is contained within, and allowed by factual or insightful academic experience of the individual in the area within which understandings are attempted. These understandings are still dependent upon created or re-created experiences of comparative history.
3. Mature.-- Mature time understandings are held by the individual commensurate with age and experience. They are adequate for handling all related problems and questions.

- a. Academic in scope.-- Dependent upon data learned relative to periods, people, and events.
- b. Abstract in scope.-- Concepts which are imaginative and creative in terms of ability to integrate historical facts into multi-dimensional conceptualizations of social studies understandings. These understandings are dependent upon the academic for content. 1 Imagination and creation are the bases for interpreting and analyzing factual data. This analysis must take place within accepted standards.

Figure 2 presents a graphic description of these stages of time understanding development which allows a comparative analysis of their similarities and differences.

Levels of understanding.-- Within any learning situation there is a developmental approach to proficiency. Three levels within this development are defined to display growth of time understandings. These are: (1) Primary Knowledge, (2) General Knowledge, and (3) Proficient Knowledge.

These terms have been constructed as a practical aid to test construction, and are a quantitative statement within the theoretical development of time understanding. Their definition follows:



Past, present and future coincide. All concepts in terms of IMMEDIATE and GENERAL effect. Behavior may indicate separation of past and future, but understanding does not.

Past, present and future separating. Still overlap, but past and future separating because of PERSONAL or ACADEMIC experiences. Approaching MATURE, but retaining RUDIMENTARY.

Past, present and future in correct separation. Past and future meet in the present, and effect of each to the other apparent. ABSTRACT reasoning and ACADEMIC experience apparent.

Figure 2. Graphic Description of the Three Stages of Time Understanding Development

1. Primary knowledge.-- Primary knowledge is a beginning knowledge. It is the initial or inaugural part of understanding which is the origin of future understanding. The learner has the elements, or outline, of the areas of learning. All

learning should enter through this frontier of learning. This is the lowest order of understanding.

2. General knowledge.-- This level of understanding is achieved by a broad view of the subject under consideration. The learner can generalize his knowledge. This is a higher order of understanding than the primary, but is lower than the proficient level.
3. Proficient knowledge.-- At this level of understanding the learner is expert. He can show his mastery by insightful decision making, and can solve problems and perform operations with a high degree of skill. This level of understanding is held by the accomplished and experienced learner. This is the highest order of understanding.

CHAPTER II

REVIEW OF THE LITERATURE AND RESEARCH

Many social studies writers and researchers have discovered, and reported, the presence of the time understanding factor in their work. There seems to be considerable disagreement as to the nature of the development and growth of these concepts. There is, however, considerable agreement as to the bases, and use of time concepts. The purpose of this chapter is to explore the various areas of time understanding consideration in terms of (1) the development of time understandings, (2) the growth of time understandings, (3) the relationships of these understandings to social studies, (4) the bases of time understanding, (5) efforts to measure the understandings, and (6) the testable areas of time understanding.

1. Development of Time Concepts

Initial development of the concept of time in the infant is slow and difficult. "Time is at first discontinuous."^{1/}

^{1/}A. Gessell, and F. H. Ilg, et al, Infant and Child in the Culture, The Development of Home and Nursery School, Harper and Company, New York, 1943, p. 21.

At that time, when early concepts of time are being developed, they are only a few of the basic ideas that the child must learn ^{1/} about being, and movement. It has been pointed out by Harrison that the first sense of time is in terms of simultaneities.

"At 18 months a child has grasped the meaning of NOW. Not until two years old does he comprehend SOON. Appreciation of time and time words is dependent upon motor capacity and motor self control. A four year old may recognize that he is bigger or smaller than others, and also that he is older, or younger." ^{2/}

An understanding of the past is next to develop. This development is, of course, dependent upon the growth of memory.

As the infant grows and develops through childhood, the slow process of concept development continues. As his activities and vocabulary development accelerate, so does his development of time concepts. The exact connection between learning activity and time understanding development is difficult to formulate. ^{3/} The speed of development is similarly elusive. Wilmeth points out that:

"The child's time concepts develop approximately in

^{1/}M. Lucille Harrison, "The Nature and Development of Concepts of Time Among Young Children," Elementary School Journal (March 1934, 34:507-514.

^{2/}Gessell and Ilg, loc. cit.

^{3/}John Richard Wilmeth, An Experiment in Teaching Time Relations in Junior High School American History, Unpublished Ph.D. Dissertation, Cornell University, Ithaca, N. Y., 1943, p. 32.

proportion to his chronological age. The purely mathematical concepts are the last to be acquired and they are usually mastered by the age of twelve."

At any rate the development and use of time concepts takes place early in the child's life, certainly before school age arrives.

"Children begin to place things in time even before they enter school. But below the fourth grade the reach of their memories is too short to impart meaning to any considerable period of time." ^{1/}

^{2/}
Harrison reports that children must master time early to use the vocabulary of time intelligently. This factor, of course, indicates that the development of rudimentary time concepts would take place before the talking age, which is usually between two and three. She further emphasizes, however, that during the early years the family makes most of the time adjustments for the child. The routine of the day makes time an important, even if not understood, item of every day life. "His ideas of punctuality, of measurement and passage of time, are, of course, of the haziest and will remain so until he becomes responsible as an individual to a time regulated society." ^{3/}

^{1/}Henry Johnson, Teaching of History in Elementary and Secondary School With Applications to Allied Studies, New York, MacMillan Company, 1940, p. 203.

^{2/}Harrison, op. cit., p. 507.

^{3/}Ibid. p. 508.

This place of responsibility will usually arrive with the beginning of school attendance. Although the family still makes most of the adjustments for the child, the school-society pressures create a desire to conform to the time pattern. To do this the child creates a need and ability in terms of time understanding.

Although great emphasis is placed on the inception of time understanding with the correlative inception of vocabulary growth, it must be recalled that real time understanding is conceptual in nature. The rudimentary use of time vocabulary as a substitute for real understanding is an evidence of this low level of operation. Wesley and Wronski ^{1/} point out: "The child of three has little understanding of time. 'Tomorrow', 'today,' and 'yesterday' are mere verbalisms."

Further evidence of the time consuming complexity of the time understanding development is emphasized by Brownell and Hendrickson: ^{2/} "It takes time (relevant experience) to formulate concepts. The child gains by step-wise growth in most instances."

^{1/}Edgar B. Wesley, and Stanley P. Wronski, Teaching Social Studies in High Schools, D. C. Heath Company, Boston, 1958, p. 441.

^{2/}National Society for the Study of Education, Part I, Learning and Instruction, Forty-ninth Yearbook, 1950, Chapter IV, University of Chicago Press, pp. 92-128, (See Brownell and Hendrickson, "How Children Learn Information, Concepts, and Generalizations.") p. 113.

"A concept is far more than a word."^{1/}

The converse is true, however, in terms of relating initial development of time concepts with vocabulary development.

"Long before the young child possesses language, as we know it, he gives plenty of evidence that he can, and does, react to objects not present to the sense, by means of nonverbal representations, probably in the form of imagery."^{2/}

^{3/} Ames studied the time concepts of very young children and concluded this pattern of development:

"First the child is able to respond suitably to a time word; next he is able to use it himself in spontaneous combination; lastly he is able to answer correctly questions dealing with the concept. Words indicating present time come in first, developmentally; then words indicating future time, and finally words denoting past time."

^{4/} Jarolimek indicates that from birth to age six, the child is developing time concepts such as today, yesterday, tomorrow, the day of the week, clock, calendar, etc.

^{1/}Brownell and Hendrickson, op. cit., p. 94.

^{2/}Ibid., loc. cit.

^{3/}Louise Bates Ames, "The Development of the Sense of Time in the Young Child," The Pedagogical Seminary and Journal of Genetic Psychology, Child Behavior, Animal Behavior, and Comparative Psychology, 1946:68:97-125, p. 115.

1/
Preston emphasizes that some of the useable time concepts are not present until much later in the child's experience:

"When children reach the intermediate grades they are capable of appreciating some of the vastness of time and the differences in length between various historical periods. Such appreciation, however, is inclined to be inaccurate and vague unless, again, graphic foundations for thinking are provided."

The graphic foundations for thinking that are mentioned here are time lines. These, of course, are only one of the factors which affect time understanding. Wesley and Wronski 2/ point out this factorial function of time understanding and social adjustment. They feel that social adjustments are related to a factor which in turn is related to time understanding. This, of course, emphasizes the need for realistic experiences, and responsibility with accompanying need to learn.

Some of the researchers feel that time concepts could be developed earlier if they were put early in school programs. "Most children probably could grasp time relationships earlier than they do if schools emphasized them from the beginning, in kindergarten. Teachers who do so, report gratifying results." 3/

1/Ralph C. Preston, Teaching Social Studies in Elementary School, Rinehart and Company, New York, 1958, p. 240.

2/Wesley and Wronski, op. cit., p. 442.

3/Preston, op. cit., p. 235.

Conversely, Brown and Brown ^{1/} indicate that not all children will develop a sense of time understanding.

It is apparent that some confusion exists relative to the initial development of time concepts. The researchers place this development all the way from infancy to senior high school, and suggest a possibility that some will not develop the sense at all.

2. Growth of Time Concepts

From the initial development of time understanding there is a slow growth and maturation process which carries many to an adult and mature understanding of time and of the implications of time relationships in the history of men and their activities. There is, of course, a varying individual rate of development and growth. There are, of course, many factors which affect this rate of growth.

There is general agreement that the growth of time understanding is a slow process. Oakden and Sturt ^{2/} were among the early researchers to discover this.

^{1/}Ralph A. Brown, and Marian R. Brown, "Time and Chronology in the Social Studies," School Review(September 1953) 62:341-345, p. 341.

^{2/}E. C. Oakden and Mary Sturt, "Development of the Knowledge of Time in Children," British Journal of Psychology (April 1922), 12:309-336.

1/
Friedman substantiates the slow growth factor by pointing out that the time concepts of adults are weak, therefore, they must be weak in children. He also asserts that: to a large extent these (time) concepts of the child develop outside organized school instruction."^{2/}

^{3/}
Pistor generalizes on this point by indicating that it is assumed that children can study time if they can read. As a result of this, he points out, there is a lack of orderly presentation in the textbooks.

In another work, Friedman indicates that the growth of time understanding can, and should be aided. The areas within which the teacher should concentrate are: (1) vocabulary of the description of time, (2) the growth and extent of historical perspective, and (3) the growth and extent of the use of spatial time.

1/Kopple C. Friedman, "Time Concepts of Elementary School Children," Elementary School Journal (February 1944), 44:337-342, p. 337.

2/Ibid., p. 341.

3/Frederick Pistor, "How Time Concepts are Acquired by Children," Educational Method (November 1940), 20:107-112, p. 107.

While questioning children, Friedman ^{1/} noted that older children were more interested in time than the younger children. This interest factor may be a force which affects the rate of growth.

Level of interest and type of formal and informal educative experience must be a growth factor. Kelty ^{2/} indicates that the growth of time understanding is dependent upon experiences:

"It is to be remarked, however, that a child must relive experiences of people in the past by means of imagination and thus gradually build up for themselves, sequences from which the time element may be abstracted, rather than accepting the meaningless abstractions of others."

As the growth of time understanding proceeds, and an opportunity for its use increases, a greater breadth of concept development is apparent. Use of the time senses is felt by Johnson ^{3/} to aid growth. "We must nevertheless continue our appeals to the time sense, and we may safely assert on general principles that the more consciously the time sense is used, the better the time sense will be."

^{1/}Kopple C. Friedman, "The Growth of Time Concepts," Social Education(January 1944), 8:29-31, p. 30.

^{2/}Mary G. Kelty, "Time Expressions Comprehended by Children in the Elementary School," Elementary School Journal(April 1925), 25:522-528, p. 523.

^{3/}Johnson, op. cit., p. 208.

Some of this use must be in the form similar to drill exercises. ^{1/} Harrison points out that the participation in a routine adds to the growth of time knowledge and understanding. As routine increases, measurement of time begins. As experience with adult conversation partners broadens, the child begins to add time experience to the vocabulary. She cautions, however, that personal experience, alone, would not allow the generalizations or abstractions which are necessary for complete and correct concepts of time.

It has been indicated, earlier, that time understanding is very complex. This being true, it would seem that there is no one way to create growth or learning in terms of time understanding. ^{2/} Schindler cautions that time understanding is not a step-by-step process alone. "Building a time sense does not proceed from the specifics of telling time to arranging dates in sequence to drawing conclusions and seeing relationships; rather all these learnings come together as children work in

^{1/}Harrison, op. cit., p. 509.

^{2/}National Council for the Social Studies, Skills in Social Studies, Twenty-fourth Yearbook, 1953, Chapter X, The Council, Washington, D. C., p. 196-225. (See Schindler, et al, "Development of a Sense of Time and Chronology, p. 199.)

social problems that have meaning and purpose to them."

The growth of time concepts during school years is not what it should be, regardless of the presence of an organized program.

"The research clearly indicates that it would be extremely naive to expect pupils in elementary and secondary schools, even with systematic instruction, to display all characteristics of one with a mature sense of time relationships. The following types of learning experiences illustrate the kinds of activities which should help pupils progress toward maturing in this respect."^{1/}

Flickinger includes in this list: (1) Showing units of time by referring to the child's family, (2) Defining abstract time words by reference to child's experience, rather than to time reckoning, (3) Show specific dates when referring to time period names, e.g., ancient, medieval, etc., (4) Use time lines of the child's own life to add realism to the concept, (5) Use "overview" time lines, not complex ones, (6) Place related events in chronological order, (7) Always bridge events from now to then.

It is, however, difficult to create situations within which time learning experiences can take place. Wesley and Adams^{2/} point out that:

"When it is desirable to teach a pupil something beyond

^{1/}Flickinger and Rehage, op. cit., p. 110.

^{2/}Wesley and Adams, op. cit., p. 302.

their experience, the good teacher first provides a basis in a field trip, an activity, or a project. But the teacher cannot provide experiences involving time; not completely, only the calendar and slow maturation can do that."

There is, also, a difference between time and chronology in terms of children's ability to learn and use knowledge.

"Time relationships are taught in primary grades, and let chronology wait until pupils have experienced a few more years."

This indicates that children do grow from their initial differences in the development of time relationships. It also points out the differences between these two factors of time conceptualization.

^{1/}
Jarolimek notes an orderly growth of time from infancy to age fifteen in this manner: (1) Up to age six; starting development of word time concepts, (2) From six to nine; maturing, but still not developed concepts of time, (3) From nine to eleven; concepts of time and chronology still not mature, beginning to see some sequence to past events, and (4) From eleven to fifteen; greater understanding of concepts of time and place.

There are many references to the growth of time concepts from infancy to high school. There is, however, no new material

Jarolimek, op. cit., p. 388.

to present. All writers seem to agree that time understanding ability grows through a slow and difficult process. There are many writers who feel that this growth and maturation process could be aided by direct teaching. The many possible teaching aids which are offered have one central theme. This central theme, seems to be making the material realistic to the child, in terms of his own experience. This is valid since, of course, conceptual learning should be introduced to the child through a known concept.

3. Relationship of Time Concepts and the Social Studies

There is, of course, a connection between the concepts and understandings of time and the concepts and understandings of social studies. Conceptual knowledge usually depends upon the understanding of other concepts which act as a basis for the new learning. Time understanding provides this base for social studies conceptualizations. Pistor ^{1/} emphasizes this factor: "Basic to a true understanding of any study of the past, however, is the child's ability to understand the various periods of time in proper relation to the present." DeKiewiet ^{2/} relates the

^{1/}Frederick Pistor, "How Time Concepts are Acquired by Children," Educational Method(November 1940), 20:107-112, p. 107.

^{2/}C. W. DeKiewiet, "The Meaning of Historical Time," Social Education(January 1945), 9:13-15, p. 13.

concepts of time to failure in teaching and learning history:

"The failure to use historical time, sometimes called organic or psychological or durational time, lies at the root of many teaching difficulties and explains the lack of understanding of the historical approach to knowledge. Without this sense of time, on the part of the student, social studies learnings may become a series of meaningless facts. Without time relations facts are not historical; without dates time relations are dimly perceptible and in a series can only convey an impression of before or after too vaguely placed for reckoning the lapse of time."

^{1/}

Preston indicates that time understanding is in the learning framework of social studies and that: "Study of history needs for value, insight into relationships between past and present."

Preston feels that this need for time understanding should be provided for by the teacher: "Clarification of time relationships directly related to the content will be needed."

^{2/}

There are, as Preston indicates, certain precautions which must be

heeded: "Chronological sense is important because it makes the study of history meaningful, chronology, however, is not his-

^{3/}

tory." Provision for only one part of the time understanding framework, in remedial "pill" form would not be sufficient. The

^{1/}Preston, op. cit., p. 235.

^{2/}Ibid., p. 244.

^{3/}Ibid., p. 236.

total scale of time relationship conceptualization is necessary. Certain parts of this framework will be used more frequently, but the approach to historical time understanding and a broad application of social studies knowledge and the implication of these knowledges required all types and bases of time understanding.

There are no writers in this field that indicate other than a strong connection between social studies knowledge and time conceptualization power.

4. Bases of Time Relationship Understanding

In Chapter I the three main bases of time understanding were described, and attributed to Wesley and Adams.^{1/} There are, however, other writers in the field who substantiate the findings of Wesley and Adams, and who add information relative to these three bases. The three bases generally described in the literature are (1) Associative, (2) Spatial, and (3) Mathematical.

^{2/}Wilmeth discusses these three bases in his work and points out:

"There are a number of psychological bases for con-

^{1/}Wesley and Adams, op. cit., p. 303.

^{2/}Wilmeth, op. cit., p. 32.

ceiving time among which are the mathematical, the spatial, and associative. Probably most people use all three, although a given individual may prefer one to the others. In the study of history, however, the use of the mathematical concepts is indispensable."

In emphasis of this point DeKiewiet ^{1/} indicates that the historian must use the mathematical to know precisely in what relation a series of events are. Johnson ^{2/} mentions this same factor, but denotes that the law of association must be used on important events.

Wesley, writing with Wronski ^{3/} utilizes these three bases of time understanding and development. They emphasize that people do not use one or the other exclusively. "Experience and inclination seem to dictate choice of a basis rather than age or intelligence. The teacher must use all three."

The three bases of time are used generally, by writers to denote growth, or base of time understanding alone. When these bases are combined with other social studies learning to become a new understanding and technical tool of historical and social learning, a new term is introduced. Historical time understanding is a more meaningful base for social studies learning. This

^{1/}DeKiewiet, op. cit., p. 14.

^{2/}Johnson, op. cit., p. 214.

^{3/}Wesley and Wronski, op. cit., p. 438.

conceptualization must use the basic time understanding as a root for its operation. Real meaning for social studies is thus founded. DeKiewiet ^{1/} describes its function: "Historical time does not emphasize exact units and successive intervals of time. It depends upon the ideas of duration and continuity. In dealing with events it is less interested in the movement of their occurrence than in their activity and vitality.

To display this historical time basis in contrast with other bases, DeKiewiet ^{2/} uses the term mechanical time. This mechanical time would include any approach or understanding of an event that would result from the sole use of either an associative, spatial, or mathematical basis. When these bases are placed in combination with appreciation of other contemporary forces, historical time would result. Let us consider the invention of the cotton gin as an event to describe these approaches, as DeKiewiet did.

The associative basis, alone, would produce the notion that Eli Whitney invented the cotton gin WHEN he was a young man. The use of the spatial basis would bring the student to the conclusion that the cotton gin was invented in the late part of

^{1/}DeKiewiet, op. cit., p. 14.

^{2/}Ibid., p. 13.

the 18th Century. The use of the mathematical basis would show the cotton gin being invented before 1800, or in 1792. All of these are true, but are mechanical, and although the invention is an historical fact, they do not give a true historical understanding of the importance of the event. The historical time basis would state that the introduction of the cotton gin in 1792 profoundly influenced the problem of slavery in the South. DeKiewiet indicates that the kind of conclusion is concerned with the continuous influence of the cotton gin in a complex social and economic situation, and during an extended period of time. "The trained historian moves from one concept of time to the other according to his needs. He does so spontaneously."^{1/}

Thus, we discover that there are currently three bases of primary time understanding whose combination with other knowledge and appreciation will produce conceptual understanding of historical time to act as a predicate for social studies learning.

5. Efforts to Measure Time Concepts

There have been many efforts to measure time understandings.

^{1/}DeKiewiet, op. cit., p. 13.

Most noticeable among these efforts have been the tests of ^{1/}Pistor and ^{2/}Friedman. Both of these tests and all other major effort in the field had been performed prior to 1945.

^{3/}Pistor's test was constructed in 1938. This test was designed mainly to act as a resource research instrument, producing data for curriculum research. It was a battery of four tests which measured four specific abilities felt to be important by the author. These sub-tests were (1) Time Order Relationships, (2) Time Absurdities, (3) Time Analogies, and (4) Time Causal Sequence. Pistor's own description of the test was:

"The need was shown for the study of the development of children's time concepts as a basis for intelligent planning of the elementary school social studies program. Time concepts were analyzed in terms of curriculum elements and psychological processes involved in studying time relationships between two or more curriculum elements. A battery of four Time Concepts tests were devised and proved. They were valid and reliable instruments for further ^{4/}research in the development of children's time concepts."

Friedman's test was constructed in 1943. This test consisted of a series of tasks and questions related to time understand-

1/"Measuring the Time Concepts of Children," op. cit., p. 293.

2/"The Growth of Time Concepts, op. cit.

3/"Measuring the Time Concepts of Children," loc. cit.

4/Pistor, op. cit., p. 300.

ing from kindergarten to grade eight. The kindergarten and early primary grades were questioned orally, while the rest of the test was paper and pencil type. The test dealt with vocabulary, chronology, and historical perspective. In 1945, Friedman and Marti ^{1/} built and validated a test for junior and senior high school. The test was similar to Friedman's first test but tested the upper grade levels. This test was in four parts, i.e., (1) Vocabulary, (2) Chronological Sequences, (3) Time Line Construction, and (4) Historical Sequence. The test was constructed, primarily, to measure the difference in an experimental and control situation, produced from the direct teaching of time understandings.

A test of similar nature was constructed and used by Wil-^{2/}meth. This test utilized true-false and rearrangement items as a major part of its measurement. This test was constructed in 1943.

^{3/}Sanford and Cottle mention tests which would measure knowledge of dates. The items shown in their presentation are rearrangement tests. Similar Time Sequence tests were discussed

^{1/}Kopple C. Friedman and Viola Marti, "A Time Comprehension Test." Journal of Educational Research, (September 1945), 39:62-68, p. 62.

^{2/}Wilmeth, op. cit., p. 82.

^{3/}Clarence D. Sanford, and Eugene Cottle, Social Studies in the Secondary School, McGraw Hill Book Company, Inc., New York, 1952, p. 296.

by Bining and Bining.^{1/} They indicate rather definite feelings about the nature of these tests.

"In history especially, the time element is important. Not more than four or five items should be given in each question or sequence of this form, for one error might result the entire answer to be wrong. The sequences or groups should represent varying degrees of difficulty. From its nature, this form should not be used alone, But should form part of a test in which other new type forms are included."

Bining and Bining did not, however, construct a major test of their own.

^{2/}
Harrison investigated the nature and development of time concepts in kindergarten through grade three. During this investigation tests were constructed and evaluated to support the investigation. These tests were an integral part of the study and served no purpose in general use. These tests were constructed in 1933.

^{3/}
Wesley and Wronski created a short test of vocabulary and chronological association to poll adult groups for ranking and placing in terms of adult concepts. There is no similar instrument for elementary schools. This test concerned itself with

^{1/}Arthur O. Bining and David H. Bining, Teaching the Social Studies in Secondary Schools, McGraw Hill Book Company, Inc., New York, 1952.

^{2/}Harrison, op. cit., p. 509.

^{3/}Wesley and Wronski, op. cit., p. 440.

eighteen items, and demanded a range of dates be attached to abstract time terms.

^{1/}
Calahan produced a test at Boston University, in 1952. The testing technique utilized was completely arrangement. This test sampled a narrow range of curriculum based time understandings.

Few tests have been constructed, and of these only two have been used to any great degree. These two tests were constructed in the late 1930's and early 1940's, and have not been revised or revalidated to reflect new findings and practices in formal and informal education.

6. Testable Areas of Time Understanding

The research indicates that there are five areas of time understanding which are important and would yield a cross section of the multi-factors of conceptualization in the time understanding area. These five areas are: (1) Vocabulary, (2) Knowledge of Time Systems and Relations, (3) Ability to Solve Time-oriented Problems, (4) Abstract Time Relationships, and (5) Time Inter-relationships.

^{1/}Mary G. Calahan, The Construction and Evaluation of a Test of Time Relationships for Grade V, VI, VII, and VIII, Unpublished Ed.M. Thesis, Boston University School of Education, 1952.

Vocabulary.-- Vocabulary testing will reflect a very im-
 portant part of time relationships understanding. Pistor,^{1/}
 in his study of this area points out that the time vocabulary
 of children is developmental, moving from common to complex.
 This, of course, would allow development to be measured.

^{2/}Friedman reports: "The vocabulary that is descriptive of time
 is extremely limited, but is used constantly. Time words
 and dates show a lack of sufficient understanding even by Grade
 6." In another discussion of this matter, Friedman^{3/} also cites:
 "The growth and extent of the language of time, that is, the
 words, phrases, and dates by which men describe time is import-
 ant in the time concepts of life."

^{4/}Friedman and Marti incorporated a vocabulary test as part
 of the time relationship test which they constructed in 1944.
^{5/}Kelty, ^{6/}Johnson, and ^{7/}Brown and Brown indicate the difficulty
 of time word comprehension. ^{8/}Harrison reports: "Children must

^{1/}"How Time Concepts are Acquired by Children," op. cit.

^{2/}"Time Concepts of Elementary School Children," op. cit., p.339.

^{3/}"The Growth of Time Concepts," op. cit., p. 29.

^{4/}Friedman and Marti, op. cit., p. 62.

^{5/}Kelty, op. cit.

^{6/}Johnson, op. cit.

^{7/}Brown and Brown, op. cit.

^{8/}Harrison, op. cit., p. 507.

master time early to use the vocabulary intelligently.

Among the learnings which a child must master himself in his early years are the ability to understand time and the ability to use the vocabulary of time intelligently." Ames ^{1/} and Wesley ^{2/} and Wronski report the importance of time vocabulary understandings, and research to indicate the weakness with which many use and understand it.

Knowledge of Time Systems and Relations.-- An investigation of this area will indicate the degree to which an individual understands the basic facts and definitions. Pistor ^{3/} includes ordering events by time as a part of his test on time understandings and points out: "Basic to a true understanding of any study of the past, however, is the child's ability to understand the various periods of time in proper relation to the present." Friedman ^{4/} stresses the order of development of time concepts. He utilizes the term time concepts in relation to time systems. Emphasis on chronology, time systems and time relations is a

^{1/}Ames, op. cit., p. 112.

^{2/}Wesley and Wronski, op. cit.

^{3/}"How Time Concepts are Acquired by Children," op. cit.

^{4/}The Growth of Time Concepts, op. cit.

dominant part of his study. Johnson ^{1/} emphasizes the need for facts to be time-oriented. He points out that facts cease to be historical if the time when and the place where is not known and appreciated. This understanding of when must be predicated upon a knowledge of time systems and relations. Flickinger ^{2/} when summarizing research, notes that the comprehension of conventional systems of reckoning time is a generally noted and researched area of time factor evaluation.

Ability to Solve Time-oriented Problems. -- Friedman ^{3/} asserts that there should be a growth of the spatial use of time and that this important factor should be implemented in education. Wilmeth ^{4/} cites this as the mathematical ability being the last to present itself. This importance in maturation makes it important to measure. Johnson ^{5/} emphasizes the importance of this ability to exercise the imagery of the value quantity of time understanding. Cassell ^{6/} in an investigation of children's

^{1/}Johnson, op. cit., p. 203.

^{2/}Flickinger, op. cit., p. 109.

^{3/}"The Growth of Time Concepts," op. cit.

^{4/}Wilmeth, op. cit.

^{5/}Johnson, op. cit.

^{6/}Mabel E. Cassell, What Measures Do Children Know and Why, Unpublished Ed.D. Dissertation, Boston University School of Education, 1941.

knowledge of measures, included an item on time problems.
^{1/}
 Brown and Brown list the ability to deal with time quantity
 as a step in time understanding development. Harrison^{2/}
 emphasizes the basic ability to symbolize and conceptualize
 time and to use this to solve problems, is refined as the child
 progresses into maturity. Friedman and Marti^{3/} list problems
 and problem solving ability as a portion of their test relative
 to time lines. Preston^{4/} shows that time problem solution is
 important in evaluation and teaching.

^{5/}
Abstract Time Relationships.-- Friedman reporting on ele-
 mentary school time concepts, indicates that abstract terms of
 time mean nothing to very young children. As children progress,
 the understanding of these abstractions attain variable degrees
 of proficiency. Kelty^{6/} points out that: "... a child must
 relive experiences of people in the past by means of imagination."
 This gradually builds up the past by imagination. DeKiewiet^{7/}
 indicates the area of abstraction as an area he calls "histori-

^{1/}Brown and Brown, op. cit.

^{2/}Harrison, op. cit., p. 514.

^{3/}Friedman and Marti, op. cit.

^{4/}Preston, op. cit.

^{5/}"Time Concepts of Elementary
 School Children," op. cit.

^{6/}Kelty, op. cit.

^{7/}DeKiewiet, op. cit.

cal time." In this area, he explains, we are less interested in the occurrence of events, but in their activity and vitality. ^{1/} Brown and Brown point out the need for development of an abstract "feeling" for time. Michaelis ^{2/} and others make reference to the need for time lines, graphs, dates, etc., to make the abstraction of time concepts concrete. To evaluate the success of understanding in this area would be a valuable addition to a time understanding test.

Time Inter-relationships.-- Time in combination with other knowledges brings true social studies learning. We have then, brought realism to fact and utilized time to lend the quantity of correct perspective. ^{3/} DeKiewiet notes the difference between mechanical time (dates) and historical time (integration of chronology and duration and continuity.) He contrasts the notion that: "Eli Whitney introduced the cotton gin in 1792." with the thought that: "... the introduction of the cotton gin profoundly influenced the problem of slavery in the South."

^{1/}Brown and Brown, op. cit.

^{2/}John U. Michaelis, Social Studies for Children in a Democracy, Prentice Hall, Englewood Cliffs, N. J., 1956.

^{3/}DeKiewiet, op. cit., p. 113.

^{1/} Hemming stresses the importance to place the school in space and time. Brown and Brown ^{2/} indicate the need for realism and the introduction to the complexity and inter-relatedness of the present world. Wesley and Adams ^{3/} note the historical need for time and space relations. This is a factor different from the other factors since it demands combination of understandings. He also directs teachers to make the significance of dates clear and to show the order and sequential development of history true. Wesley and Wronski ^{4/} show the inter-relatedness of time systems with other social studies data with an example of an individual's inability to fully comprehend Lincoln's Gettysburg Address without a knowledge of the meaning of "score."
^{5/} Preston cites the example of the relatedness of the child's life with periods of time gone by. The inter-relatedness of the area should be evaluated as a factor of time understanding.

Research done by the foregoing and others, show no other

1/James Hemming, *The Teaching of Social Studies in Secondary Schools*, Longmans, Green and Company, New York, 1949.

2/Brown and Brown, *op. cit.*

3/Wesley and Adams, *op. cit.*, p. 305.

4/Wesley and Wronski, *op. cit.*, p. 439.

5/Preston, *op. cit.*

major division of time understanding which could lend itself, well, to evaluation in a time understanding test.

7. Summary

There seems to be considerable confusion in the literature about the initial development of time concepts. There is a wide range of ages at which researchers place this beginning. There is, however, considerable agreement about the effect of the home, school, and informal educative experiences upon time understanding. There is some variation of opinion relative to aiding the growth and development of these concepts by direct teaching. Time understanding and the resultant conceptualizations must be developed within the child's framework of understanding.

Social studies knowledge depends very heavily upon time understandings. There is generally three bases for these time understandings. These three bases are: (1) Associative, (2) Spatial, and (3) Mathematical. A dimension of understanding referred to as historical time is utilized by many authors.

1/ Pistor and 2/ Friedman have constructed important time re-

1/Frederick Pistor, "How Time Concepts are Acquired by Children," Educational Method(November 1940), 20:107-112.

2/Kopple C. Friedman, The Growth of Time Concepts, unpublished Ph.D. Dissertation, University of Minnesota, 1943.

lationship tests. These tests, however, were constructed more than fifteen years ago, and in most other areas of curriculum research it has been found that children today, are more sophisticated in their understanding and learning level.

There are five areas which are found to be valuable for time relationship measurement. These areas are: (1) Vocabulary, (2) Knowledge of Time Systems and Relations, (3) Ability to Solve Time-oriented Problems, (4) Abstract Time Relationships, and (5) Time Inter-relationships.

CHAPTER III

TEST CONSTRUCTION, ADMINISTRATION, AND ANALYSIS PROCEDURES

1. Test Construction

A time relationship test was constructed in these five parts: (1) Vocabulary, (2) Knowledge of Time Systems and Relations, (3) Ability to Solve Time-oriented Problems, (4) Abstract Time Relationships, and (5) Time Inter-relationships.

Research indicates that these areas of time understanding are important and will yield a cross section of the multi-factors of conceptualization in the time understanding area.

A description of the steps involved in this test construction follows. An overview of the total test construction effort may be seen in Figure 3. This flow chart includes all of the steps which are present in the total study. Although the outline of the blocks is in IBM flow chart format, only parts of the procedure have utilized IBM aid.

Planning the test.-- A test plan was constructed on the basis of the research. The statements, which guided the item construction steps, were formulated in terms of the intended item's general area, specific area, time relationship basis,

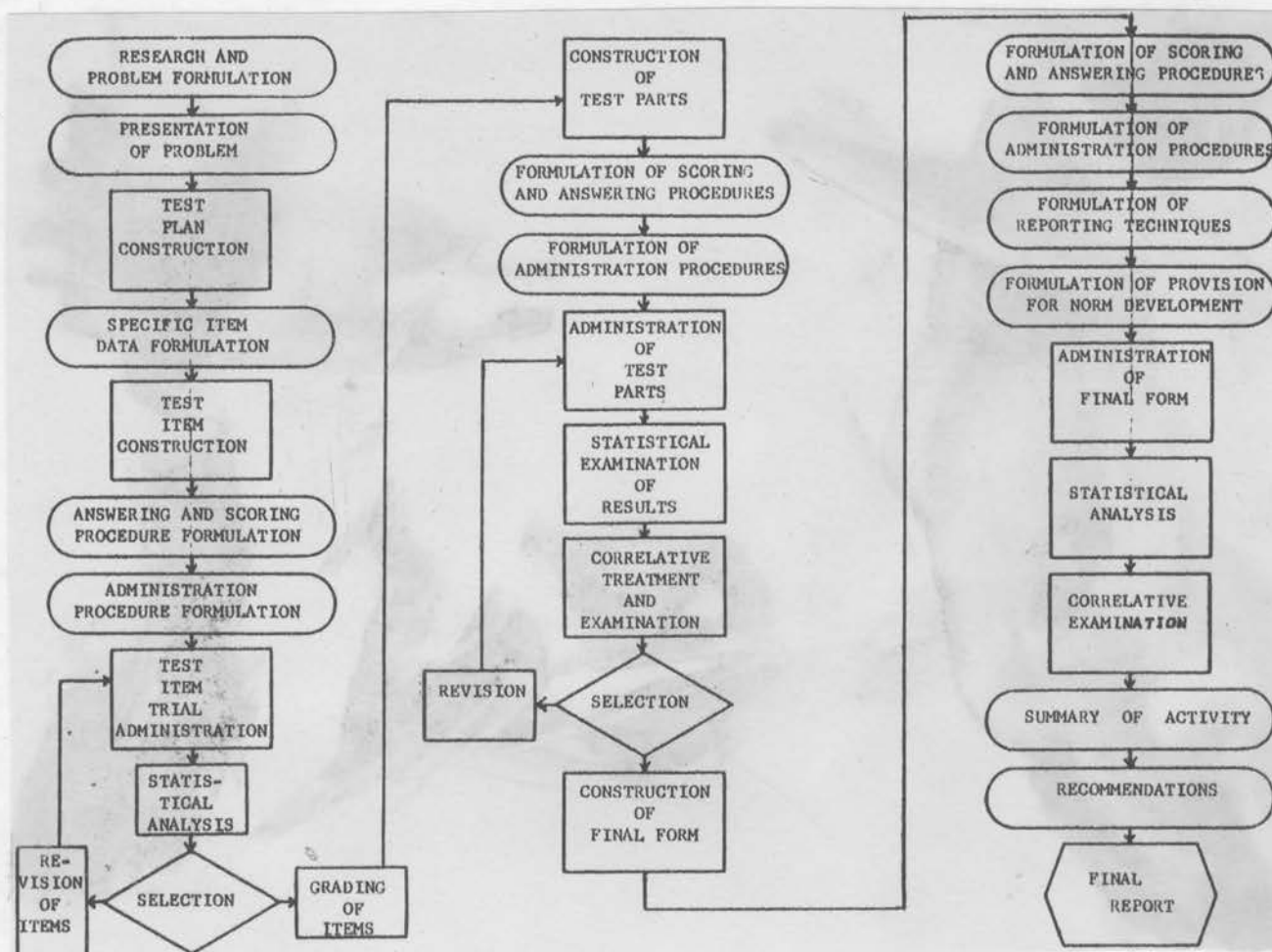


Figure 3. Flow Chart of Specific Procedures in the Test Construction Process

and desired level of understanding. An example of this would be an item testing Knowledge of Time Systems by knowledge of hours and minutes, using a spatial basis, and tested at the primary level of understanding. Figure 4 illustrates the format used for this test planning procedure. The test plans for the two test forms constructed during this study appear as Appendix B.

TEST PLAN				
Test or Test Set Title _____				
Date _____ Revision/New Test _____ Test ID Nr _____				
Purpose _____				
GENERAL AREA	SPECIFIC AREA	NR OF ITEMS	BASIS	LEARNING LEVEL

Figure 4. The Test Plan Format used in the Test Construction Procedure

Test item construction.-- According to the test plan, the material gathered for construction into item form was placed into standard item format. Factual data which were commensurate with the educational level of the child were used. These data were extracted from standard textual materials which were cited in accepted statements of school curriculum. This material was validated by the number of test administrations through which it went before being selected for use in the final test forms. The standards for item selection forced the choice of an item for a particular grade level. In addition, the vocabulary level was controlled by comparing it with standard statements

of vocabulary. Among the many sources used were the Lorge-
Thorndike, ^{1/} and the Earley ^{2/} and Wolffer ^{3/} work. These two
different types of lists gave a good view of vocabulary level.

Test item trial.-- The test items were administered to
populations which constituted the range of grades for which
the item was intended. The items were tried on small groups
of children. When a population of at least one hundred chil-
dren, of a given grade level had been reached the item was
considered to be ready for examination, selection, and/or
revision, and placement into a trial test part. Standards
for the selection of these items were planned in advance and
the selection of these items was made according to these fac-
tors. The standards for item selection were (1) difficulty
index between .40 and .80, (2) discrimination index above .35,
and (3) all distractors being used.

^{1/}Edward L. Thorndike, and Irving Lorge, The Teacher's Word
Book of 30,000 Words, Bureau of Publications, Columbia Univer-
sity, Teachers College, New York, 1944.

^{2/}William J. Earley, Jr., The Construction and Evaluation of a
Social Studies Vocabulary Association Test for Intermediate
Grades, Unpublished Ed.D. Dissertation, Boston University
School of Education, Boston, 1952.

^{3/}William A. Wolffer, The Construction and Evaluation of a Social
Studies Context Vocabulary Test, Unpublished Ed.D. Dissertation,
Boston University School of Education, Boston, 1952.

Test part construction.-- The test parts, or sub-parts for trial administration were constructed from the items selected in the above process. These parts were constructed for the three bases of time understanding within each of the five test divisions. Each of the levels of understanding were represented within these tests. Test parts, to reflect each time understanding basis and each level of understanding, were constructed for intermediate grade children, and for junior high children. The intermediate test parts were designed for use with grades four, five, and six. The junior high test parts were designed for use with grades seven and eight.

Test part trial.-- These test parts were administered to appropriate populations. When a population of at least one hundred children for a given grade level, had been reached, the sub-test was considered to be ready for examination, selection, revision, or placement into the test. The standards for the selection of these parts were formulated before hand and were as follows: (1) mean difficulty between .40 and .80, (2) mean discrimination between .30 and +1.00, (3) standard deviation relationship to mean close to that of a normal population, e.g., $M = 10, SD = 2$; $M = 20, SD = 4$; $M = 50, SD = 10$, etc., and (4) reliability above .60.

Final form construction.-- The final forms of the test were constructed, according to the master test plan, from the validated test parts. There were two final forms. Each test consisted of 80 items. Test Form INT62 was intended for use with the intermediate grades, Test Form JRH62 was intended for use with grades seven and eight. (See Appendix A.)

2. Test Administration

Materials for administration.-- The Time Understanding Test was administered with the testee indicating his answers on IBM Port-A-Punch cards, overprinted as test answer cards. An IBM Port-A-Punch card is much like a regular IBM card with one exception; the punch areas, in which data may be placed, are perforated. These perforations allow the user to punch information into the card with a simple stylus, without further, special equipment. The card does not require a keypunch machine. A sample of an IBM Port-A-Punch card appears as Figure 5.

With these perforated areas over-printed as answer sheets, the testee may punch his answers into the card. During the test, responses are circled, then the testee punches his responses into the card with a stylus. A sponge backing is used to cushion the card and to catch the perforations.

The use of this Port-A-Punch card constitutes the only

NAME										RANK										SERVICE NUMBER										TEST NO									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D

Figure 5. IBM Port-A-Punch Card Over-printed for use as a Test Answer Card

administrative difference between this test, and regular objectively scored multiple choice test instruments.

Standard directions for administration were used, which dictated time limits. The time of administration did not exceed one hour, including directions. The standard test directions are included as Appendix C.

Test populations.-- The time test items, which were administered on a trial basis, during the test construction procedures were administered in Danvers, Massachusetts, Fitchburg, Massachusetts, and Leominster, Massachusetts. These trial test administrations were performed without formal control of time

of day, condition of administration, etc. The basic purpose of this action was to provide data for the grading, revision, and selection of time test items for the final test forms.

The final forms of the Test of Time Relationship Understandings were administered to 150 to 200 children in each grade level from four to eight. These children were drawn from grades four through eight in the school of Lunenburg, Leominster, and Townsend, Massachusetts. The tests were administered to children in grade units.

3. Test Scoring and Analysis

The Port-A-Punch card, originated by the student, provided direct input to an IBM 650 Computer which had been programmed to accept this card as source data, perform scoring and analysis computation, and to put-out, in punched card form, the results of this action. This scoring and analysis program provided basic statistical data and student scores. Hand-scoring of the Port-A-Punch cards provided further raw score data.

Basic statistical analysis.-- The test result data, in the form of statistical test characteristics necessary for item selection, test part selection, and to support the scoring and validation steps was received from the IBM Computer. This analysis produced the following indices: (1) Number tested,

(2) High raw score, (3) Low raw score, (4) Mean score, (5) Standard error of this mean, (6) Standard deviation, (7) Variance of the test, (8) Reliability, (Kuder-Richardson Formula 20), (9) Reliability, (Corrected with Spearman-Brown Prophecy Formula), (10) Standard error of measurement, and (11) Average difficulty of the test. Figure 6 shows a sample of this type of machine listing produced by the processing procedures.

1	2	3	4	5	6	7	8	9	10	11
52	69	36	49.50	1.09	7.87	61.87	.70	.82	4.34	.62
101	65	27	45.77	.81	8.12	65.93	.70	.82	4.43	.57
153	69	27	47.4	.66	8.21	67.46	.72	.83	4.38	.59
	PART I		16.2	.36	2.62	6.88	.30	.74	2.19	.70
	PART II		16.83	.35	2.50	6.23	.35	.78	2.01	.76

Figure 6. Accounting Machine Print-out of Computer Produced Test Characteristics

As a part of the test characteristics, a graphic item count was produced. This table shows the number of individuals responding to each distractor of each test item. The difficulty level must be attached to this chart by consulting a pre-computed table of item difficulty indices. Figure 7 shows a machine produced graphic item count. The plus (+) sign attached to

070	A	59+	B	45	C	74	D	27
071	A	48	B	55	C	58+	D	36
072	A	44	B	48	C	64+	D	42
073	A	31	B	55	C	52+	D	62
074	A	18	B	30	C	71+	D	88
075	A	80+	B	38	C	39	D	42
076	A	79+	B	80	C	28	D	16
077	A	30	B	17	C	139+	D	11
078	A	37	B	33	C	81+	D	46
079	A	93+	B	17	C	78	D	10

Figure 7. Accounting Machine Print-out of Computer Produced Graphic Item Count

a particular distractor indicates that this is the correct answer.

Although a discrimination index was computed and utilized during the item trial and selection steps, it was not computed on the final test. Item discrimination does not contribute to the interpretation or utilization of test results. Once an item has passed selection standards satisfactorily, if it has content validity, the discrimination index becomes useless.

Individual scoring.-- Each individual's test responses were corrected, during the computer process, for the Total Test Score, and for part test scores in five parts. For the Total Test, the processing produced the following individual scores: (1) Standard Score (Mean = 100, SD = 20), (2) Raw Score, (3) Rank

in the class, and (4) Per Cent Score. For each of the five parts of the test the processing produced the Standard Score and Per Cent Score. A part raw score was computed, by hand, for the three bases of time understanding, and for the three levels of understanding.

Intercorrelation of test parts.-- Each of the test parts were correlated with each other part. This computation indicated the uniqueness of measure of each part, and the contribution each part made to the total test.

Correlation with other data.-- The results of the final test administration, both composite and test part were correlated with other test results for these populations. An analysis of randomly selected subjects was made to determine the uniqueness of measurement, nature of result, and validity of evaluation of the time understanding test. The measures which were used to perform this validation step were: (1) Otis Quick Score Intelligence Test, (2) California Test of Mental Maturity, (3) Metropolitan Achievement Test, (4) Iowa Test of Basic Skills, and (6) Sequential Tests of Educational Progress. The IQ tests located the relationship of the time measure and IQ. The test composite and part result of the time test, when compared to certain part scores of the achievement tests re-

vealed the relationship with general achievement in school, reading, social studies, arithmetic, and work-study skills.

Validity.-- Validity was established in terms of (1) Content Validity, i.e., test planning, vocabulary control, (2) Concurrent Validity, i.e., correlation with Friedman's test, and (3) Construct Validity, i.e., correlation with intelligence and achievement measures.

Computer and calculator aid.-- The IBM 650 Computer was used to score and analyze test parts and the final form. Input data was provided by Port-A-Punch cards, used as answer sheets by the testees. Scoring and analysis for the various statistics mentioned above was done during the same step. Electric calculators were utilized to convert the hand-scored raw data to test characteristics, and correlative data.

CHAPTER IV

RESULTS OF THE TEST SCORING, ANALYSIS, AND COMPARISON OF DATA

1. Test Scoring

Hand scoring.-- The IBM Port-A-Punch cards which the students used as answer cards were hand-scored in the first step of the analysis procedure. This hand-scoring provided part scores for areas in which particular items contributed to more than one test part. Items of this nature could not be scored in this manner by the computer. These raw score data provided information about the student's achievement on test items related to the three bases of time understanding, i.e., associative, spatial, and mathematical, and within the three levels of understanding, i.e., primary, general, and proficient.

During the hand-scoring step the test answer cards, and resultant scoring data were separated by the particular grade in which a test had been administered. Total grade scoring was accomplished by use of the electronic computer.

The purpose of separating the data was to allow correlative comparison of the test result with other measures of achievement

and intelligence. Rather than limiting such examination to a single measure of achievement of intelligence, an attempt was made to utilize populations which had been previously measured with a variety of such tests. This, of course, demanded separate treatment of data by group, and particular test. Although the population numbers in each correlative group was smaller, the resultant data are broader in scope and will be meaningful to a variety of school situations.

Computer scoring.-- The secondary step was computer processing. Part scores by activities within time understanding were computed, i.e., Vocabulary, Knowledge of Time Systems, Ability to Solve Time-oriented Problems, Abstract Time Relationships, and Time Inter-relationships. A total, or composite score, was also accumulated during the process.

Item values.-- All of the test items in both test forms were equally weighted; each item carried a value of one raw score point for a correct response. The test plans, which appear as Appendix C, are keyed by item number to show which items correspond, or contribute, to each part test score. The items which contribute to the defined test parts, e.g., Part I, Part II, etc., have been placed sequentially within the test, and are so marked. The items which contribute to the part scores

for bases of time understanding or levels of understanding are scattered throughout the test and the testee is not aware of them as such. Each item in the test contributes to four scores, i.e., (1) Test Part, (2) Total, (3) Time Understanding Basis, and (4) Level of Understanding.

Types of scores.-- Raw scores were retained for all of the test parts. Deviation scoring, percentiles, or per cent scores were not calculated for these data because of the limited use that would be served in test analysis and data comparison.

During the accumulation of rosters containing test data, the scores for other achievement measures for these populations were gathered to allow comparison, by correlation, of the results.

Normative scores.-- Percentile ranks and standard scores, i.e., Z-scores with a Mean = 100, and Standard Deviation = 20, have been constructed for each grade level based upon the data received from these test administrations. The normative scores for Test Form INT62 are included in Appendix D. The normative scores for Test Form JRH62 are included in Appendix E. The use of these data in future test administrations is intended, as a form of standardization. Increased reliability of these scores could be achieved by accumulating added data and amplifying these results.

2. Test Analysis

Basic statistical analysis.-- The raw score data which were collected from the test scoring step were utilized to compute test characteristics. The data derived from hand-scoring were analyzed with a test scoring and analysis sheet which appears in Appendix F. The formulas presented on this sheet represent a synthesis of statistical formulas adapted from material presented by Gulliksen.^{1/} Electric calculators were used to support statistical analysis of the hand-scored data. The raw score data derived from computer scoring were further processed in the 650 Computer with a similar analysis program. The 650 Computer processing also rendered a graphic item count for each set of data.

Analysis by total test.-- Table 1 shows the Total score characteristics, by grade, for Test Form INT62. Table 2 shows the Total score characteristics, by grade, for Test Form JRH62. These tables, and all succeeding tables for test characteristics, include data to reflect: (1) number tested, (2) mean, (3) standard deviation, (4) mean difficulty, and (5) reliability. In these and all succeeding charts the M and N suffixes on grade

^{1/}Harold Gulliksen, Theory of Mental Tests, John Wiley and Sons, Inc., New York, 1950.

level indicates the city from which the population was drawn. Grades 7 and 8 were all from one school system eliminating the necessity for such notation.

The reliability measure which is presented here was computed by an internal consistency formula, i.e., Kuder-Richardson Formula $20 \frac{1}{K}$ and was based only upon the number of items which the test contains. No test length prophecy formula was utilized. By common standards this underestimates the reliability of test parts which contain less than twenty items.

Table 1. TOTAL Score Test Characteristics on Test Form INT62
(K = 80)

Grade	N	M	SD	M Diff	R_{tt}
4M	84	39.38	10.98	.49	.83
4N	127	41.10	9.64	.51	.77
Total 4	211	40.73	9.74	.51	.79
5M	93	44.16	9.36	.55	.77
5N	74	47.22	8.78	.59	.75
Total 5	167	45.77	7.90	.57	.70
6M	84	51.23	8.40	.64	.75
6N	103	52.48	8.48	.66	.68
Total 6	187	52.26	8.72	.65	.76

1/J. P. Guilford, Psychometric Methods, McGraw-Hill Book Company Inc., New York, 1954, p. 380.

The mean performance in each test, and in each grade shows, in every case, a positive progression of improved performance. The mean performance for Grade Four is always lower than that of Grade Five; Grade Five always lower than Grade Six. Comparative analysis of Grade Six and Grade Seven does not display this movement. Grade Six was evaluated using Test Form INT62, and Grade Seven was evaluated using Test Form JRH62. The test content in each of these measures is similar, but the factors which are different are significantly different, and were designed to produce different results.

Table 2. TOTAL Score Test Characteristics on Test Form JRH62
(K = 80)

Grade	N	M	SD	M Diff	R _{tt}
7	153	43.53	9.84	.54	.79
8	142	48.37	8.79	.60	.75

The progressive differences observed indicate that the knowledge which the test is evaluating is progressive, or developmental, in nature.

The patterns of dispersion indicated by the standard deviations do not display such consistent variation. A trend

is noted which indicates that the increase of mean performance diminishes the differences which exist within the group. This shows that the skill or knowledge which is being measured is developing in most members of the group.

Individuals who achieve a high degree of skill at certain ages or grade levels seem to plateau in their progress. The people whose skill is not as great, initially, seem to progress rapidly during these plateau periods. All lower members of the group seem to be involved. This would explain the rise in mean performance, and restriction of differences. With an unchanged ceiling, the progress of the rest of the group has the effect of diminishing the standard deviation and increasing the mean. Table 3 demonstrates a justification of this theory by an exam-

Table 3. Range of Total Test Scores
for Test Form INT62

Grade	High Raw Score	Low Raw Score
4	64	17
5	65	27
6	70	45

ination of the ranges of total test scores for INT62. Note that the total improvement for high score is six raw score points; the improvement for low raw score is 28 points. This would bear out the assumptions that time understanding is developmental from rudimentary to mature.

The reliability indices indicated for the total test are more than adequate to insure reliable measurement at these grade levels. The reliability measures indicate a relatively less reliable test as the grade level increases. This factor, again, indicates the presence of a developmental aspect in the skill or knowledge being evaluated. The internal consistency formula utilized depends strongly upon observed and constant differences in the populations tested. As these differences diminish, as in the measurement of an inter-related developmental skill package, the differences are not as discreetly different. Indiscreet differences do not lend themselves to consistent measurement, or theoretical computation of indices of consistency.

All factors commented upon above are present in the data displayed in Tables 1 and 2, which denotes a similarity of performance and significance for Test Form INT62 and Test Form JRH62.

Analysis of Part I.-- Table 4 shows the characteristics

Table 4. PART I, Vocabulary, Score Test Characteristics on
Test Form INT62 (K = 23)

Grade	N	M	SD	M Diff	R _{tt}
4M	84	12.85	4.44	.56	.71
4N	127	12.97	4.75	.56	.68
Total 4	211	12.89	4.28	.56	.69
5M	93	14.04	4.02	.61	.66
5N	74	14.97	3.70	.65	.62
Total 5	167	14.45	3.90	.63	.65
6M	84	14.80	6.22	.61	.85
6N	103	16.51	3.02	.72	.49
Total 6	187	15.52	4.94	.67	.79

of Part I of INT62. This section of the test consists of 23 items designed to evaluate the testee's vocabulary of time understanding.

An examination of the mean performance of the various groups indicates that progressive improvement in knowledge, or skill, is displayed through the grades. Vocabulary and the use of vocabulary in time understanding develops as the child progresses through school. His ability to use time terms improves as he matures.

The progressive restriction of the population, indicated by diminishing standard deviations, does denote an increasing similarity of skill on the part of the testees. As the children

progress in the grades they not only develop but seem to become more similar, in their understanding of time terms.

Table 5 displays the characteristics of the Vocabulary section, which is Part I, of Test Form JRH62. The Vocabulary section of JRH62 consists of 20 items. The same progressive improvement of skill, and restriction of differences in the

Table 5. PART I, Vocabulary, Score Test Characteristics on Test Form JRH62 (K = 20)

Grade	N	M	SD	M Diff	R_{tt}
7	153	13.69	3.57	.68	.66
8	142	15.34	2.72	.77	.52

group is present on this form, with Grades 7 and 8, as that shown by INT62 with Grades 4, 5, and 6. The sub-test shows a reliability of measurement which is more than adequate. This is true of both test forms. The test becomes less reliable as the group differences diminish.

Analysis of Part II. -- Table 6 is a record of the characteristics of Part II, Test Form INT62. This part of the test consists of 22 test items designed to evaluate the group's knowledge of time systems and relations. The group in Grade 4

Table 6. PART II, Knowledge of Time Systems and Relations, Score Test Characteristics on Test Form INT62 (K = 22)

Grade	N	M	SD	M Diff	R_{tt}
4M	84	14.28	3.55	.65	.60
4N	127	14.31	2.91	.65	.41
Total 4	211	14.29	3.36	.65	.56
5M	93	14.69	2.38	.67	.14
5N	74	16.16	3.10	.73	.53
Total 5	167	15.34	2.78	.70	.42
6M	84	17.12	3.10	.78	.53
6N	103	16.92	2.59	.77	.17
Total 6	187	15.42	4.94	.67	.79

began the progressive improvement of skill noted in this area with a relatively high proportion of items correct, i.e., 65%. This point provided a measurement base for improvement to 77% correct in Grade 6. The restriction of group differences was not as noticeable in this knowledge of time systems sub-test. The sub-test was adequately reliable with some unexplained changes for particular grades being tested.

Table 7 shows this same area for JRH62. Knowledge of Time Systems and Relations section was Part II of Test Form JRH62. This section consisted of 15 test items. The same progressive improvement is noted with no restriction, or diminishing, of group differences. The test was adequately reliable. Added

caution should be made not to compare proportional difficulty between Test Form INT62 and Test Form JRH62. These are different tests with a different number of items.

Table 7. PART II, Knowledge of Time Systems and Relations, Score Test Characteristics on Test Form JRH62 (K = 15)

Grade	N	M	SD	M Diff	R_{tt}
7	153	9.13	2.45	.61	.41
8	142	9.52	2.60	.63	.48

Analysis of Part III.-- Table 8 shows the test characteristics for Part III of Test Form INT62. This section consists of ten test items designed to evaluate ability to solve time-oriented problems. These items involve a problem solving technique with some dependence upon historical fact and mathematical computation.

The mean performance of individuals is, again, characterized by progressive improvement through the grades. This improvement is constant and runs a range of 17% of the test. There is no significant restriction of the group displayed by the standard deviations. Evidently the total group develops at the same pace, maintaining the same differences. The reliability indices for this sub-test are, for the most part, negative. Be-

Table 8. PART III, Ability to Solve Time-oriented Problems, Score Test Characteristics on Test Form INT62 (K = 10)

Grade	N	M	SD	M Diff	R_{tt}
4M	84	4.31	1.54	.43	-.03
4N	127	4.55	1.55	.46	-.03
Total 4	211	4.38	1.69	.44	.15
5M	93	4.76	1.18	.48	-.21
5N	73	5.22	1.45	.52	-.38
Total 5	167	4.96	1.27	.50	-.21
6M	84	5.33	1.83	.53	.25
6N	103	5.86	1.78	.59	.24
Total 6	187	5.63	1.82	.56	.25

cause of the relatively small number of items (ten) in the part, and because of the degree of content validity in the test, this factor is being discounted as insignificant. This evidence does not show that the measure is not a useful part of the test. As the population progresses the measure becomes more reliable and, as noted in JRH62, is consistently positive.

An explanation of this phenomenon may be that the factors which are being measured are taught in school. As they are taught, measurement of them is affected. The noting of real and consistent differences becomes reliable. Before appearance as a result of formal learning, however, differences are dependent upon informal learning experiences. Informal learning is spurious and does not support indicated reliable measurement.

Table 9 shows the test characteristics for Part III of Test Form JRH62. This is also a sub-test with 10 items designed to evaluate ability to solve time-oriented problems. The development of this skill in Grades 7 and 8 is progressive, but not

Table 9. PART III, Ability to Solve Time-oriented Problems, Score Test Characteristics on Test Form JRH62 (K = 10)

Grade	N	M	SD	M Diff	R _{tt}
7	153	5.58	1.77	.56	.22
8	142	5.98	1.65	.60	.12

significantly so. It is noted that neither the mean nor the standard deviation shift significantly. The group does not progress, or grow more alike from Grade 7 to Grade 8. This may indicate a plateau of development with this skill since growth had been noted in Grades 4, 5, and 6. As noted in the discussion about Part III of INT62, the reliability indices of this part are low positive. This part, however, has only 10 items as did Part III of the intermediate test.

Analysis of Part IV.-- Table 10 shows the characteristics of Part IV of Test Form INT62. This sub-test is composed of 11 test items designed to evaluate abstract time understandings.

Time lines, and graphic descriptions of time and event are the content of this sub-test. Many schools emphasize these data in their learning material. The mean performance of the group is progressive as the grade increases. The low performance of

Table 10. PART IV, Abstract Time Relationships, Score Test Characteristics on Test Form INT62 (K = 11)

Grade	N	M	SD	M Diff	R_{tt}
4M	84	3.50	1.75	.32	.22
4N	127	4.09	1.82	.37	.22
Total 4	211	3.83	1.88	.35	.29
5M	93	4.40	2.04	.40	.36
5N	74	4.92	1.90	.45	.26
Total 5	167	4.87	1.73	.44	.30
6M	84	5.45	2.27	.50	.47
6N	103	5.69	1.99	.52	.30
Total 6	187	5.58	2.25	.51	.46

of the fourth grade indicates that although some children know these concepts, they have not been taught them as a part of formal learning. The consistent patterns of dispersion and retention of differences during development indicates proportional growth by all group members. This test part shows reasonable reliability for such a small number of items, and like Part III, improves as the group progresses. This, again, indicates that the skill is being taught somewhat; differences become more

reliable.

Table 11 shows the nature of the result on Part IV of JRH62. This sub-test consists of 15 items designed to evaluate abstract time understanding in Grade 7 and Grade 8. The mean performance is progressive in improvement from Grade 7 to Grade 8. The standard deviation shows a decrease. This decrease must be due

Table 11. PART IV, Abstract Time Relationships, Score Test Characteristics on Test Form JRH62 (K = 15)

Grade	N	M	SD	M Diff	R_{tt}
7	153	6.41	2.42	.43	.38
8	142	7.27	2.38	.48	.33

to the increased homogeneity of this knowledge. This is a reliable sub-test. The reliability indices are high when the number of test items, and the history of the sub-test in the intermediate grades, is considered.

Analysis of Part V.-- Table 12 contains the test characteristics for Part V of Test Form INT62. Part V consists of 14 test items designed to evaluate understanding of time inter-relationships. The evaluation plan in this section called for items which would test the child's understanding of data which combined

Table 12. PART V, Time Inter-relationships, Score Test
 Characteristics on Test Form INT62 (K = 14)

Grade	N	M	SD	M Diff	R _{tt}
4M	84	5.08	2.47	.36	.47
4N	127	5.30	1.55	.38	-.12
Total 4	211	5.28	2.17	.37	.30
5M	93	4.96	3.22	.35	.69
5N	74	6.16	2.60	.44	.39
Total 5	167	5.49	3.00	.39	.63
6M	84	6.62	3.12	.47	.64
6N	103	7.49	2.47	.53	.42
Total 6	187	7.81	2.81	.51	.46

person, place, event, etc., into one situation. Historical time provided a basis for many of these items. Historical time, of course, is multi-factored. Many non-verbal type items were used which consisted of pictures designed to escape reading and to test a child's knowledge of the artifacts of time.

The mean performance on this sub-test was not a constant progression of improvement as the child proceeded through the grades. Particular groups seem to differ. This may indicate a desirability of one curriculum, or methodology, over another since these differing groups were from different schools or cities. The degree to which children were alike, as displayed by the standard deviations of the scores, indicated that differ-

ences were neither constant nor progressive. Performance that differs so significantly must be the result of teaching material in one area, and not teaching this material in another. The performance of Grade 5 in this area may indicate that such data are presented as teaching points in Grade 5.

The test is reliable except as reflected by one of the test groups. The other indices of reliability are good and constant; little can be determined outside of the fact that the one negative reliability index must be spurious.

Table 13 displays the characteristics of Part V on Test Form JRH62. This section has 20 items and was designed to evaluate the understanding of time inter-relationships. With the junior high we see an even progression from Grade 7 to Grade 8. The diminishing of the standard deviations indicates that this sub-test is measuring a skill or knowledge which is maturing in the group being measured. As the individuals mature, they become more alike, thus reducing spread, or differences. This sub-test

Table 13. PART V, Time Inter-relationships, Score Test Characteristics on Test Form JRH62 (K=20)

Grade	N	M	SD	M Diff	R_{tt}
7	153	8.72	3.15	.44	.51
8	142	10.20	2.95	.51	.44

is reliable for seventh and eighth graders.

Analysis of the evaluation of the Associative Basis.--

Table 14 shows the performance characteristics of 33 items designed to evaluate the use of the associative basis of time understanding. These items all utilize comparison as a basis for the determination of the correct answer. No specific date, event, or person is involved in correct answer determination. The associative basis has been characterized, in this paper, by the statement, "Washington cut down a cherry tree WHEN he was a boy."

The capable use of this basis is progressively better through the grades. The populations seem to be achieving with-

Table 14. ASSOCIATIVE BASIS Score Test Characteristics on Test Form INT62 (K = 33)

Grade	N	M	SD	M Diff	R_{tt}
4M	84	15.17	4.92	.46	.66
4N	127	15.88	4.56	.48	.60
Total 4	211	15.46	4.78	.47	.65
5M	93	17.72	3.73	.54	.41
5N	74	17.70	4.75	.54	.64
Total 5	167	17.71	4.21	.54	.54
6M	84	19.94	4.83	.60	.66
6N	103	21.32	4.23	.65	.58
Total 6	187	20.70	4.56	.44	.63

in this basis toward a total group improvement. The dispersion of the group does not change appreciably. Although mean performance improves as the grade increases, the same degree of difference exists, as indicated by the standard deviations.

The grouping of items within this framework, and scoring based upon the associative basis alone, provide a reliable measure of ability.

Table 15 shows the result of an associative basis evaluation with the seventh and eighth grades. This evaluation is based upon 29 test items in Test Form JRH62.

Table 15. ASSOCIATIVE BASIS Score Test Characteristics on Test Form JRH62 (K = 29)

Grade	N	M	SD	M Diff	R_{tt}
7	153	16.41	3.92	.57	.54
8	142	18.48	3.70	.64	.51

This measurement indicated a rather dramatic increase in mean performance, and a restricting of differences in the group. This may indicate the the plateau, and "catching-up" period takes place between Grade 7 and 8. The evaluation was reliable at this level, but diminishes in reliability as the group differences diminish.

Analysis of the evaluation of the Spatial Basis.-- Table 16 records the characteristics of an evaluation of the spatial basis of time understanding. Twenty-nine items in Test Form INT62 were used as an indication of skill using the spatial basis. These items used linear visualization of time, e.g., time lines, graphs, etc.

Table 16. SPATIAL BASIS Score Test Characteristics on Test Form INT62 (K = 29)

Grade	N	M	SD	M Diff	R_{tt}
4M	84	14.76	3.90	.51	.52
4N	127	15.14	3.21	.52	.32
Total 4	211	14.95	3.67	.52	.45
5M	93	16.33	3.75	.56	.49
5N	74	17.35	3.25	.60	.44
Total 5	167	16.78	3.57	.58	.45
6M	84	18.32	3.12	.63	.30
6N	103	18.24	3.59	.63	.47
Total 6	187	18.28	3.32	.63	.63

The mean performance of Grades 4, 5, and 6 increases as the grade increases. All members of the group seem to be growing at the same rate. The pattern of dispersion within the group is being maintained. The standard deviations do not diminish greatly; coupled with the indicated reliability, across-the-board improvement is evident.

Table 17 shows the spatial basis data for Grades 7 and 8. More progressive improvement in mean performance is evident. It is noted, however, that the group differences are diminished significantly. The conclusion which may be drawn here is that the entire group is maturing in the use of this basis of time understanding. As more people mature, or become proficient, more people are alike. This similarity, because it does involve improvement of members of the group, increases mean performance. Because this similarity increases there is a "bunching" of people about a new and higher mean, the standard deviation diminishes causing a resultant drop in reliability. These drops in reliability would seem to be a function of the group nature rather than the nature of the test content. Since reliability

Table 17. SPATIAL BASIS Score Test Characteristics on Test Form JRH62 (K = 30)

Grade	N	M	SD	M Diff	R_{tt}
7	153	15.51	4.17	.52	.57
8	142	17.41	1.72	.58	.38

indices demand relative treatment, such relatively wide degrees of acceptability should be justified by the content, and by the mobility of the testee's individual and group performance.

Table 18. MATHEMATICAL BASIS Score Test Characteristics on
Test Form INT62 (K = 18)

Grade	N	M	SD	M Diff	R_{tt}
4M	84	10.13	2.81	.56	.44
4N	127	10.12	3.16	.56	.66
Total 4	211	10.13	3.01	.56	.59
5M	93	10.60	2.80	.60	.46
5N	74	12.04	2.79	.67	.49
Total 5	167	11.24	2.89	.62	.49
6M	84	12.94	2.06	.72	.14
6N	103	12.87	2.52	.72	.43
Total 6	187	12.90	2.32	.72	.72

Analysis of the evaluation of the Mathematical Basis.--

Table 18 shows the characteristics of INT62 scores based upon 18 test items designed to evaluate use of the mathematical basis of time understanding. These items have to do, largely, with a sense of quantity in time understanding.

The development of mean performance within this basis of time understanding increases as the grade increases. Group differences displayed by the standard deviations are maintained throughout Grades 4, 5, and 6, indicating total group, positive and proportional development. There seems to be, as with the other bases of time understanding, no plateau effect in Grades 4, 5, and 6, indicating arrival at mature operation across these

particular grade levels.

This measure of time understanding, as a sub-test, is reliable.

Table 19 displays the characteristics of 21 test items in Test Form JRH62 designed to evaluate the mathematical basis of time understanding in Grades 7 and 8.

Table 19. MATHEMATICAL BASIS Score Test Characteristics on Test Form JRH62 (K = 21)

Grade	N	M	SD	M Diff	R_{tt}
7	153	11.75	3.28	.56	.52
8	142	12.63	3.09	.60	.47

There is, again, a progressive improvement of mean performance. No decrease of group difference is indicated by the standard deviations in this basis of time understanding. In terms of the mathematical basis of time understanding, the group seems to be continuing improvement at this level of education, rather than forming a maturity plateau.

The evaluation of this factor provided a reliable measurement of these groups.

Analysis of the evaluation of Primary Understanding.-- Table 20 shows the result of an evaluation, with 17 items of the

primary level of understanding with Test Form INT62. The items which contribute to this part-score are a mixture of items designed to evaluate test-part subject areas, and bases of time understanding. All of these items, however, are of such a nature as to be classified as primary understanding. These items concern labels, names, single factor learnings, etc. The items represent the lowest level of understanding.

Table 20. PRIMARY UNDERSTANDING Score Test Characteristics on Test Form INT62 (K = 17)

Grade	N	M	SD	M Diff	R _{tt}
4M	84	11.21	3.03	.66	.59
4N	127	11.45	3.02	.67	.59
Total 4	211	11.33	3.00	.67	.59
5M	93	11.68	2.90	.69	.57
5N	74	13.08	2.67	.77	.39
Total 5	167	12.29	2.94	.72	.60
6M	84	13.71	2.14	.81	.37
6N	103	13.35	2.14	.79	.39
Total 6	187	13.51	2.22	.79	.43

The mean performance of Grades 4, 5, and 6 indicate a progressive accumulation of these data which represent primary understanding. The groups justified the label of primary by starting in the fourth grade with the relatively high proportion of 66% correct. The sixth grade had progressed to a mean

achievement of 79% of the test correct.

The pattern of dispersion shows a decrease of difference. This would, again, justify the term primary since within this evaluation group the lowest level of understanding would be developed by all in a group, with the mean and extreme performance indicating increasingly similar levels.

The sub-test is reliable as a measure of skill at this level. It is noted, however, that as group differences diminish, reliability decreases. The shifting of a heterogeneous group to homogeneity is theoretically proven by this shift of reliability.

Table 21 shows the results of a primary understanding sub-test score within Test Form JRH62. This sub-score is based on 12 test items.

Table 21. PRIMARY UNDERSTANDING Score Test Characteristics on Test Form JRH62 (K = 12)

Grade	N	M	SD	M Diff	R_{tt}
7	153	8.46	2.44	.70	.58
8	142	9.27	1.84	.77	.37

The same pattern of mean improvement and restriction of group performance, with a proportional shift of reliability, is

present here as was described in the analysis of Test Form INT62. Further justification for the reasoning which recognizes the presence of complete maturity is shown by the performance of Grades 7 and 8 on Test Form JRH62.

Analysis of the evaluation of General Understanding.--

General understanding is higher than primary, and is characterized by a broad knowledge of the topic under examination. More general factors are present within the understanding of the individual. These factors are broad in nature, and are not yet completely formulated into a definable framework of knowledge. These knowledges would not depend upon particular facts, but upon a host of facts combined into insightful concepts.

Table 22. GENERAL UNDERSTANDING Score Test Characteristics on Test Form INT62 (K = 32)

Grade	N	M	SD	M Diff	R _{tt}
4M	84	15.14	4.95	.47	.68
4N	127	15.59	4.83	.49	.66
Total 4	211	15.31	4.87	.48	.66
5M	93	16.61	4.58	.52	.62
5N	74	18.20	4.40	.57	.60
Total 5	167	17.32	4.57	.54	.62
6M	84	20.28	3.37	.63	.46
6N	103	20.75	4.32	.65	.61
Total 6	187	20.54	4.07	.64	.54

Table 22 is a presentation of the characteristics of test scores accumulated by sub-test scoring of 32 items on Test Form INT62 designed to evaluate general understanding. These items are a mixture of test part related items, and items related to the bases of time understanding, but are all categorized as general knowledge.

Mean performance is positively progressive as the grade level increases. The differences displayed within the group are not progressively restricted. This indicates that all members of the group are developing proportionally, and maintaining their relative differences. The reliability of the measure would bear this out. Reliable measure is retained throughout Grades 4, 5, and 6. An assumption may be made that heterogeneity of understanding is being retained in the same proportion. The nature of general understanding which is broad, and not curricular dependent, would substantiate this reasoning.

Table 23 displays the characteristics of test scores based upon 34 items administered to both Grades 7 and 8 in Test Form JRH62 in order to evaluate general understanding. The progressive improvement of mean performance cited in the results of the other sub-tests presents a dramatic change in group dispersion. This occurs between Grade 7 and Grade 8. An accum-

Table 23. GENERAL UNDERSTANDING Score Test Characteristics on
Test Form JRH62 (K = 34)

Grade	N	M	SD	M Diff	R _{tt}
7	153	19.59	4.76	.58	.64
8	142	22.01	1.87	.65	.45

ulation of knowledge, formally and informally, must create a plateau of general understanding maturity. The sub-test results indicate an almost normal, somewhat mesokurtic, distribution in Grade 7; in Grade 8, a slightly negative skew, in a platykurtic shape is evident. According to Guilford, this is an evidence of a rise in item difficulty and an increase in item inter-correlation. The rise in item difficulty is indicated, and the increase in item inter-correlation is accepted. Both factors would justify the assumption that all testees are arriving at a similar level of maturity with the measured factor.

Analysis of the evaluation of Proficient Understanding.--

Proficient understanding has been described as an expert level of understanding. At this point we would expect the subject to show his mastery by insightful decision-making and to perform

1/J. P. Guilford, op. cit., p. 360.

problem solving with a high degree of skill. This is the highest level of understanding and is probably never completely achieved.

Table 24 is a record of the test characteristics established by scores achieved on 31 test items designed to evaluate proficient understanding. These multi-factored items, on Test Form INT62, display a mean performance which is progressively higher as the grade level increases. The standard deviations remain

Table 24. PROFICIENT UNDERSTANDING Score Test Characteristics on Test Form INT62 (K = 31)

Grade	N	M	SD	M Diff	R_{tt}
4M	84	13.56	3.41	.44	.35
4N	127	14.19	3.53	.46	.38
Total 4	211	14.07	3.50	.45	.32
5M	93	15.48	3.83	.50	.47
5N	74	15.66	4.04	.51	.53
Total 5	167	15.56	3.92	.50	.49
6M	84	17.37	3.74	.56	.46
6N	103	16.79	5.22	.54	.78
Total 6	187	16.94	6.73	.51	.83

fairly constant, indicating no great change in the differences within the groups, nor movement by the groups toward the new and higher means. The reliability indices shift, positively,

indicating that the observed differences were more consistently measured. This may indicate that the test population, through acquired knowledge, proportionally increased their basic ability to use knowledge in a proficient manner.

Table 25 indicates that this same phenomenon is true with the 34 test items in Test Form JRH62, which were designed to evaluate proficient understanding. The mean performance is

Table 25. PROFICIENT UNDERSTANDING Score Test Characteristics on Test Form JRH62 (K = 34)

Grade	N	M	SD	M Diff	R_{tt}
7	153	15.67	4.04	.46	.48
8	142	17.18	4.20	.51	.53

progressively better, and the standard deviations indicate no progressive restriction of the population. The reliability indices improve in character, thus indicating a more consistent observation of firmer differences.

Analysis of the evaluation of the Bases of Time Understanding.-- The evaluation of each of the three bases of time understanding, i.e., associative, spatial, and mathematical, has been discussed. The real significance of these three eval-

uations may be noted by an examination of combined results.

Table 26 displays an accumulation of these data for Grades 4, 5, and 6. It may be noted that in each case development, as stated in earlier analysis, is reflected in progressive improvement. Thus, on Table 26 we see, horizontally, improvement as the grade increases. The vertical development indicates

Table 26. Comparison of Mean Difficulties in the Evaluation of the Three Bases of Time Understanding on Test Form INT62

Basis \ Grade	4	5	6
Associative	.47	.54	.63
Spatial	.51	.58	.63
Mathematical	.56	.64	.72

comparative use of bases, or of a particular base. An examination of this vertical development indicates the following points.

Fourth graders use the associative basis with less facility than either of the other two; the most effectively used basis is the mathematical. This is logical since this deals, usually, with more concrete facts. The spatial basis which requires

abstract visualizations displays average difficulty while the associative basis would be the most abstract and difficult to use with accuracy.

In Grade 5 a proportional increase in the use of the mathematical basis is noted. Also, a growing similarity of skill in the use of the associative and spatial bases is present. More sophisticated and mature interchange and inter-relation of the bases of time understanding, as predicted earlier, would seem to be developing.

In the Grade 6 data progressive development of all bases of time understanding is noted. The mathematical basis has increased most substantially. The spatial and associative bases are used with equal skill and facility.

Table 27 presents an accumulation of the mean difficulties derived in the evaluation of the three bases of time understanding on Test Form JRH62 with seventh and eighth graders.

Looking at this development horizontally the characteristic progressive improvement of mean performance is displayed. Examining the vertical, or inter-basis activity, it is noted that, unlike Grades 4, 5, and 6, the associative basis has emerged as the most facile for the group to utilize. The seventh and eighth graders are using the spatial and mathematical

Table 27. Comparison of Mean Difficulties in the Evaluation of the Three Bases of Time Understanding on Test Form JRH62

Basis \ Grade	7	8
Associative	.57	.64
Spatial	.52	.58
Mathematical	.56	.60

with almost equal facility. The associative skill is continuing upward development and improvement. There seems to be a growing similarity and improvement in the use of all bases, indicating a mature skill of time usage predicated upon all bases of time understanding.

Analysis of the evaluation of the Levels of Understanding.--

The three levels of understanding have been examined separately. Each was determined to represent a reliable measure. Progressive improvement within each was noted from grade to grade.

Table 28 displays an accumulation of the evaluation of the three levels of understanding for Grades 4, 5, and 6 on Test Form INT62.

A horizontal examination of the chart shows the progres-

Table 28. Comparison of Mean Difficulties in the Evaluation of the Three Levels of Understanding on Test Form INT62

Basis \ Grade	4	5	6
Primary	.67	.73	.80
General	.48	.55	.64
Proficient	.45	.51	.55

sive improvement within each level, for the three grades.

An examination of the vertical presentation indicates that the testees at each grade level perform best on the primary level or lowest level of understanding. This is justified by the ranking of these items in the developmental manner, on these three levels.

Because these items are classified by difficulty, no proportional shift of response preference, or ability, was expected nor evidenced in the data.

Table 29 shows the accumulation of mean difficulties on the same levels of understanding evaluation for Grades 7 and 8 on Test Form JRH62. Each point established for the performance of the groups on INT62 is present and equally evident in

Table 29. Comparison of Mean Difficulties in the Evaluation of the Three Levels of Understanding on Test Form JRH62

Basis Grade	7	8
Primary	.70	.77
General	.58	.65
Proficient	.46	.51

in the results of performance on this form.

3. Comparison With Other Data

Time understanding and achievement.-- Although time understanding is related to achievement, the measurement of this factor should be free from a strict measurement of achievement alone. Usually those individuals who achieve highly in general have a better chance for high achievement on any verbal, content-oriented test. Time understanding should be free from these factors, so an examination of the achievement bias of the Test of Time Understanding follows.

Table 30 presents coefficients of correlation between various parts of the intermediate test, Test Form INT62 and the

Table 30. Coefficients of Correlation Between Test INT62
and Iowa Test of Basic Skills (N = 98)

Iowa INT62	I	II	III	IV	V	Totals
Reading	.61	.34	.28	.19	.46	.69
Arithmetic Concepts			.18			.02
Arithmetic Problem Solving			.10			.21
Work Study Skills	.58	.51	.39	.19	.38	.56

^{1/}
Iowa Test of Basic Skills.

It must be kept in mind that the conclusions based upon these coefficients of correlation are based also upon logical consideration. ^{2/} Lindquist states, "... cause-and-effect connections (if any) cannot be determined from observed correlation. (....) The observed correlation may suggest a cause-and-effect relationship, but can never prove that it exists, or show in what degree it exists."

^{1/}State University of Iowa, Iowa Tests of Basic Skills, Houghton Mifflin Company, Boston, 1956.

^{2/}E. F. Lindquist, A First Course in Statistics, Houghton Mifflin, Company, Boston, 1942, p. 204.

The Pearson-Product-Moment formula was utilized for computation of this coefficient.^{1/} This formula was not used in the case of standard score correlation. In these cases, a standard score correlation formula was utilized.^{2/}

The reading score on the Iowa Test of Basic Skills has been related to the part and total test scores on Test Form INT62. Data were not available for all of the group measured, so a random selection method was used to escape pre-designed bias. A randomly selected group of 98 individuals were used for this study.

Part I of Test Form INT62, which is a vocabulary test, relates quite strongly to reading. This bias was expected and would be difficult to escape.

The relationships displayed between Reading and Parts II, III, IV, and V are all below $r = .50$. These relationships are relatively low and permit the conclusion that these parts do not measure reading ability alone.

The total test relates to reading ability with an $r = .69$. This relatively high relationship is felt to be caused by the fact that good readers are usually high achievers, and seem to

^{1/}Lindquist, op. cit., p. 168.

^{2/}George A. Ferguson, Statistical Analysis in Psychology and Education, McGraw Hill Series, New York, 1959, p. 91.

have all of the other factors of general achievement and intelligence. Time understanding is, of course, one of these factors.

The Arithmetic Concept and Problem Solving scores on the Iowa Test were compared to Part III and Total scores of Test Form INT62. This was done to substantiate the intended function of computational items which appear in these parts. The very low correlation permits the conclusion that these items measured time elements as opposed to arithmetic skills.

Work Study Skills have an effect on development of social studies skills and ability. The relationships displayed in Table 30 do not seem to indicate that the subjects of Test Form INT62 are dependent upon these factors for success. It is interesting to note that Abstract Time Relationships, Part IV, which utilizes time lines, etc., has a low ($r = .19$) relationship with Work Study Skills.

Table 31 shows coefficients of correlation between Test Form INT62 and the Metropolitan Achievement Test. ^{1/} This test, unlike the Iowa, contains specific social studies achievement scores.

The relationships of the Social Studies Information portion of the Metropolitan has a significant bearing upon the total

^{1/}Metropolitan Achievement Test, Intermediate Battery, World Book Company, Yonkers-on-Hudson, New York, 1954.

score. The part-score correlation would seem to indicate that this relationship is effected mostly by overall success of individuals of high achievement. The sub-parts relationships are not high, with none exceeding $r = .50$.

Table 31. Coefficients of Correlation Between Test INT62 and Metropolitan Achievement Test (N = 140)

Met INT62	I	II	III	IV	V	Total
Social Studies Information	.47	.27	.32	.21	.30	.63
Social Studies Skill	.77	.49	.33	.12	.35	.49
Arithmetic Computation			.04			.12
Arithmetic Problem Solving			.10			.21
Reading	.59	.28	.21	.40	.44	.73

The Social Studies Information and Part I have a coefficient of correlation of $r = .47$. This may indicate that the sample of time words bears a slight resemblance to a sample of social studies vocabulary. This relationship is not high enough, however, to conclude that Social Studies Information

has a significant effect on this measure.

Part II, which is Knowledge of Time Systems and Relations, has a low positive relationship ($r = .29$) with Social Studies Information on the Metropolitan, as does Part III, Ability to Solve Time-oriented Problems ($r = .32$).

Abstract Time Relationships, and Time Inter-relationships have low positive relationships, thus permitting an assumption that these areas do not call too heavily upon Social Studies Information. Because of content validity, they serve more effectively in the evaluation of Time Understanding.

The Social Studies Skill portion of the test bears a relationship similar to that discussed with Social Studies Information. The overall relationship ($r = .77$) for Social Studies Skill and Part I, Vocabulary, is unexplained. These two measures must depend upon a related third factor. Social Studies Skill does not seem to effect Part II, III, of IV. Social Studies Skill, again, has a surprisingly low relationship to Part IV, which utilizes graphs, time lines, etc, and should show similar measurement.

Arithmetic Computation, and Problem Solving was compared to Part III, and the Total score. Low positive correlation in each case indicates that this skill is neither demanded by the items in which arithmetic appears, nor does the presence of the

skill hurt the testee.

The Reading portion of this achievement test is similar in relationship to that of the Iowa. The overall relationship ($r = .73$) is higher but the rationale of explanation would be the same as with the Iowa Reading scores.

Table 32 presents the coefficients of correlation between Test Form JRH62 and the Sequential Tests of Educational Progress.^{1/} The Social Studies Test and the Reading measure are compared to JTH62 in this chart.

Table 32. Coefficients of Correlation Between Test Form JRH62 and the Sequential Tests of Educational Progress

STEP JRH62	I	II	III	IV	V	Total
Social Studies	.26	.41	.32	.56	.51	.66
Reading	.62	.31	.56	.42	.61	.78

Test Form JRH62 and the Social Studies Test of the STEP have a high relationship ($r = .66$). Because the part relationships of the measure and JRH62 parts are low, it is assumed that the success factor is the cause of the high final relation-

^{1/}Cooperative Test Division, Sequential Tests of Educational Progress, Educational Testing Service, Princeton, N. J., 1960.

ship. Social studies achievement does not, according to this comparison, have a great relationship to Vocabulary, Knowledge of Time Systems, Abstract Time Relationships, or Time Interrelationships. This begins to increase justification of the assumption that time understanding, although a social studies factor is unique, and may be measured separately.

The Reading portion of the STEP has a high positive relationship with the Total JRH62 score ($r = .78$). This factor is not entertained as an effect on valid measurement because the vocabulary level of the test was controlled for fourth grade consumption with the exception of a few key words. Reading related in various degrees to each of the parts of the time test, according to the STEP measure, from $r = .31$ for Part II to $r = .62$ with Vocabulary.

Although general achievement does not seem to be specifically related to the measurement of time understanding within the various areas of Test Form INT62 and Test Form JRH62, the relatively high relationship of total achievement and understanding would indicate that Time Understanding is a factor which contributes to general social studies achievement. This factor would make time understanding data a valuable element of instructional and curricula data.

Construct validity and achievement.-- A comparison of the Test of Time Understanding data with these achievement measures permits the following observations:

1. Test Form INT62 is not a measure of general social studies achievement, i.e., low positive correlation with Social Studies Information (Metropolitan), Social Studies Skill (Metropolitan), and Work Study Skills (Iowa).
2. Test Form INT62 is not a measure of reading, i.e., low positive correlation with Metropolitan and Iowa Reading when compared with parts, with the exception of Part I, Vocabulary, which is a defined reading factor.
3. Test Form INT62 is not an arithmetic test, i.e., very low positive correlation with Arithmetic Concept (Iowa), Arithmetic Problem Solving (Metropolitan and Iowa), and Arithmetic Computation (Metropolitan).
4. Test Form JRH62 is not a reading test, i.e., positive, but not strong correlation of STEP reading score and parts of JRH62.
5. Test Form JRH62 is not a social studies test, i.e., positive, but not significant correlation, with parts of JRH62 and STEP social studies score.

These observations, coupled with a high degree of content validity, justify the conclusion that the test is an effective measure of time understanding.

Time understanding and intelligence.-- Table 33 shows the relationship of Test Form INT62 and the California Test of Mental Maturity. ^{1/} The IQ which is derived from the California is related highly ($r = .62$) to the Vocabulary section of the time test. The high relationship noted here is noted in terms of other tests of achievement, aptitude, and even intelligence.

Table 33. Coefficients of Correlation Between Test Form INT62 and California Test of Mental Maturity (N = 160)

Cal INT62	I	II	III	IV	V	Total
IQ	.62	.46	.38	.56	.32	.49

The vocabulary section of many intelligence tests has such a high degree of correlation with test success that many examiners regard vocabulary level as an adequate estimate of IQ.

The relationship of IQ and the other portions of the time test is not significant.

^{1/}Elizabeth T. Sullivan, W. W. Clark, and E. W. Tiegs, California Test of Mental Maturity, Elementary Battery, California Test Bureau, Los Angeles, 1951.

Table 34 displays the correlation between Test Form JRH62 and the Otis Quick Score Intelligence Test.^{1/} These correlations develop the same pattern as those for the comparison of INT62 with intelligence. The positive correlations are high when compared to Vocabulary (Part I), and are low when compared to the selected factors of time understanding. The total correlation ($r = .63$) is not high enough to say that this test is measuring intelligence alone. These data seem to indicate that IQ relates to each form of the time test in a similar manner.

Table 34. Coefficients of Correlation Between Test Form JRH62 and Otis Quick Score Intelligence Test (N = 123)

Otis JRH62	I	II	III	IV	V	Total
IQ	.58	.21	.45	.48	.54	.63

Intelligence seems to be a factor of general time understanding, or similarly, time understanding is a factor of intelligence.

Construct validity and intelligence.-- The comparison

^{1/}A. S. Otis, Otis Quick-Scoring Mental Ability Test, Beta Test, World Book Company, Yonkers-on-Hudson, N. Y., 1939.

of the Test of Time Understanding data with measures of intelligence permit the following observations:

1. Test Form INT62 is not a measure of intelligence, i.e., positive, but not strong correlation with California Test of Mental Maturity.
2. Test Form JRH62 is not a measure of intelligence, i.e., positive, but not high positive correlation with Otis Quick Score Intelligence Test IQ.

The assumption, again, is that if the test is not a test of intelligence, because of a high degree of content validity, it must be a test of time understanding.

INT62, JRH62, and the Friedman Test of Time Understanding.--
1/

Table 35 shows the results of an administration of the Friedman Test of Time Understanding to selected members of the population which was evaluated with Test Form INT62 and Test Form JRH62.

The Friedman test is included in this paper as Appendix G. This test consists of 71 test items with equal values of one point per item. The format of the test is a combination of multiple choice, fill-in, and arrangement. The original format of presentation was retained during this administration.

1/Kopple C. Friedman, The Measurement and Growth of Time Concepts, Unpublished Ed.D. Dissertation, University of Minnesota, 1944.

Table 35. Test Characteristics of the Friedman Test of Time Understanding (K = 71)

Grade	N	M	SD	M Diff	R_{tt}
4	43	40.23	12.09	.56	.89
5	46	45.17	8.62	.63	.72
6	25	48.72	8.01	.69	.61
Total	114	46.83	12.08	.66	.91
7	39	49.16	6.05	.69	.79
8	42	50.86	10.01	.72	.80
Total	81	50.02	8.56	.70	.82

It is noted that the Friedman test does develop a pattern of progressive improvement of performance throughout the grades. The average difficulties are acceptable under the standards set forth for INT62 and JRH62. The tests are reliable, to a very high degree. The patterns of dispersion are broad, and this wide range seems to contribute to the statistical reliability.

An examination of the material presented in the Friedman test will explain the rather broad pattern of performance. A great many of the items depend upon interpretive skills. The content data of the items are oriented, usually, to single factor situations. Many of these items would have been classified as primary understanding in Test Form INT62 or JRH62.

The high degree of performance on these items has been noted previously. Comparative examination of the results on this part of INT62 and JRH62 would confirm this observation.

The mean performance of each group is high on the Friedman test, ranging from 56% correct to 72% correct. The data presented in Friedman's original study ^{1/} do not indicate that the children in the original populations did this well. This fact permits the observation that the children in the schools today are more sophisticated in their use of time.

Table 36 is a record of the coefficients of correlation between the Friedman test and Test Form INT62 and JRH62. The observed correlations are positive but not strong. This

Table 36. Coefficients of Correlation
Between Test Form INT62,
Test Form JRH62, and Friedman
Test of Time Understanding

	INT62 (N = 114)	JRH62 (N = 78)
Friedman	.58	.62

indicates that both tests may be measuring a similar factor, but are not ranking people similarly. The Friedman test has

^{1/}Friedman, op. cit., pp. 45, 73, 111.

face validity, but its content validity could be questioned as being an adequate sample of the broad range of time understandings. Test Form INT62 and Test Form JRH62 do have a broad range of factors sampled, contributing to content validity. If the Friedman test had a higher degree of content validity these correlations would be more significant. The Friedman test was selected for this step of comparison and validation because it has had the greatest impact on this part of social studies knowledge and it is the one with the highest degree of content validity available.

The comparison of Test Form INT62 and Test Form JRH62 with the Friedman test is felt to display adequate correlation (middle positive) to establish concurrent validity for these instruments. The age (1944) and the limitations of the Friedman test are regarded as restricting factors in the relationship which has been established.

Intercorrelative comparison.-- Each part of Test Form INT62 and Test Form JRH62 has been compared to each other part. The coefficients of correlation for the intercorrelative comparison are displayed for Test Form INT62 in Table 37.

Examination of these data for Test Form INT62 indicate the following:

1. Part I, Vocabulary, has a high degree of relationship

Table 37. Intercorrelations of Test Parts, Test Form INT62
(N = 312)

Test Part	I	II	III	IV	V	Total
I		.63	.31	.29	.32	.80
II			.50	.18	.41	.88
III				.19	.51	.58
IV					.27	.33
V						.68

with Knowledge of Time Systems and Relations. This may indicate that Knowledge of Time Systems is a vocabulary skill.

2. The relationship of Part I to other parts of the test is negligible, indicating that the vocabulary of time has not been made a factor of these sub-tests.
3. The vocabulary measure is related quite strongly to the total score indicating that this is an important factor in the measurement. The research presented earlier bears this out.
4. Part I, Vocabulary, is indicated to be a unique measure of an important part of the test.
5. Part II, Knowledge of Time Systems and Relations,

relates very strongly to vocabulary, as previously stated, and has a moderate relationship to Part III, Ability to Solve Time-oriented Problems. Part III uses time systems as item content, but in an attempt to escape this as an evaluative factor it was sublimated. This attempt was evidently successful.

The relationship of Part II to other parts of the test is negligible. Knowledge of Time Systems and Relations contributes heavily to the total test, however, indicating that it is an important factor in time understanding.

6. Part II, Knowledge of Time Systems and Relations, is indicated to be a unique measure of an important part of the test.
7. Part III, Ability to Solve Time-oriented Problems, is related moderately to Knowledge of Time Systems, as previously stated and related moderately to Time Inter-relationships. This may indicate that the material in the Time Inter-relationships portion does utilize the same skill, to a limited degree, for successful performance.
8. Part III, Ability to Solve Time-oriented Problems, makes a moderate contribution to the test total. This part

is indicated to be a unique measure of a factor which does not affect the test heavily.

9. Part IV, Abstract Time Relationships, shows negligible relationship to any other part of the test. This low relationship includes the total test score. Part IV has been indicated to be a unique measure of a factor, or factors, which do not not relate to success on the test as a whole. This lack of strong relationship to the total test may indicate that the factor is not present in the testees to any degree of consistency which influence the test. Its lack of relationship to the other parts of the test justifies its separate treatment.
10. Part V, Time Inter-relationships, shows a moderate relationship to Parts II, III, and the total test. This is logical since time inter-relationships would be a combination of skills and knowledges concerned with time systems, and use of knowledge to analyze situations (problem solving). The relationship to the total test is strong enough to indicate that it is a contributing factor related to the other factors of the test.

11. Part V, Time Inter-relationships, is indicated to be a unique measure.

Table 38 shows the intercorrelation of Test Form JRH62. A justification of the above discussion is found by the similarity of intercorrelation on this test form and that of Test Form INT62. The degree of difference in the two forms, i.e., addition or deletion of factual data, was not designed to make a difference in the performance on the test. It did not.

Table 38. Intercorrelation of Test Parts, Test Form JRH62
(N = 156)

Test Part	I	II	III	IV	V	Total
I		.63	.29	.35	.65	.82
II			.56	.14	.32	.86
III				.27	.60	.52
IV					.35	.36
V						.69

All of the conclusions reached from an examination of the intercorrelations within Test Form INT62 are applicable to JRH62. One decided difference, however, is the change in the relationship of Part I and Part V. There are no data to explain this

change in Grades 7 and 8. It may be that the skill of applying logical consideration to time inter-relationships becomes closer to a vocabulary skill as the learner progresses. This shift does not, however, hurt the measurement or change the rationale presented earlier.

4. Summary

Testee responses for Test Form INT62 and Test Form JRH62 were hand-scored and computer scored. The data were analyzed with the aid of an electronic computer and electric calculators.

The basic data were analyzed by (1) test part, (2) time understanding basis, (3) level of understanding, and (4) total test. Analysis of these part scores and sub-scores established that each test form was reliable, and that sufficient dispersion of the testees was noted to adequately establish differences in the subjects and to determine the defined factors related to time understanding. In each case, test part, basis of time understanding, and level of understanding, a progressive improvement of performance was noted.

When compared to achievement and intelligence measures these test forms were found to be adequately unique and did not duplicate the evaluation of factors measured by these

achievement or intelligence instruments.

Compared to an earlier time understanding test, these tests were found to measure more factors, and to have sufficient relationship to indicate similarity without duplication.

Internally, Test INT62 and Test JRH62 proved to consist of unique measures of different factors related to total evaluation of the individual in terms of time understanding. This measure was sufficient to portray level of time understanding ability.

CHAPTER V

SUMMARY, CONCLUSIONS, EDUCATIONAL IMPLICATIONS, AND RECOMMENDATIONS FOR FURTHER STUDY

1. Summary

Purpose.-- It was the purpose of this study to construct and evaluate an instrument to measure understandings and abilities related to time concepts in school age children, Grades Four to Eight.

This testing instrument would relate the understanding of time to learning and curriculum problems in the social studies area. Such time understanding information about groups will provide data for the placement of content at certain grade levels. Information about the individual will permit accelerated teaching, remedial teaching, and more sophisticated treatment of time understanding data.

Need for study.-- There are no current instruments to insure validity when measuring time concepts and abilities in children of elementary and secondary school age. Because of the findings of previous researchers there has been a tendency to delay the teaching of social studies concepts thought to

contain reference, or dependence upon time understandings. There was, then, a need for an instrument which would render information about time understanding to serve as a basis for judgements relative to the content of the curriculum, placement of content within the curriculum, the readiness of the student to learn, or the learning condition of the student.

Hypotheses.-- There were three basic hypotheses which guided the procedures and conclusions of this study. The investigation of these hypotheses demanded the construction of a testing instrument. These three hypotheses are:

1. Time relationship understanding is a tri-factored, (associative, spatial, mathematical) element displaying parallel and inter-related growth during the maturation of the individual.
2. Children display a higher degree of sophistication in this time understanding than previous research indicates.
3. Time relationship measurement may be achieved as a separate and unique measure.

The three bases of time understanding which constitute the tri-factored element of time relationships are defined as follows: (1) The associative basis has comparison uppermost. The understanding of an event, in time, is relative to some

other event, and is not categorized chronologically. (2) The spatial basis of time understanding concerns distance, or order in a row of events. A time line capitalizes on the spatial basis. (3) The mathematical basis of time understanding concerns a sense of quantity. The use of this basis utilizes a mental image of a number in relation to time.

Test construction.-- During the investigation of the three hypotheses a time relationship test was constructed. This test was constructed in five parts: (1) Vocabulary, (2) Knowledge of Time Systems and Relations, (3) Ability to Solve Time-oriented Problems, (4) Abstract Time Relationships, and (5) Time Inter-relationships.

Research has indicated that these areas of time understanding are important and will yield a cross section of the multi-factors of conceptualization in the time relationship area.

This test of time understanding was constructed in two forms, i.e., Test Form INT62, for use with Grades 4, 5, and 6, and Test Form JRH62 for use with Grades 7 and 8. Each of these tests consists of 80 items evaluating the five test parts. Additional evaluative information is derived relative to the three bases of time understanding, i.e., associative, spatial, mathematical, and three levels of understanding, i.e., primary,

general, proficient.

The three levels of understanding which were used during this activity may be defined as follows: (1) Primary knowledge is the initial or inaugural level of understanding. (2) General knowledge concerns a broad view of the subject under consideration. This is an intermediate level of knowledge. (3) Proficient knowledge is characterized by expertness. This is the highest order of understanding and concerns the use of multifactored knowledge to solve problems and to perform high level operations.

Test administration.-- The two forms of A Test of Time Understanding were administered to school children in appropriate grades. A total of 860 children were evaluated. In Grades 4, 5, and 6, there were 565 children tested; in Grades 7 and 8, 295 children were tested. The testees responded to this test on IBM Port-A-Punch cards which provided direct input to an electronic computer for test scoring and analysis. During the test administration step, other measures of achievement and intelligence, already administered to the groups, were recorded for future comparison of results.

Test scoring and analysis.-- The respondent's cards were scored and analyzed for 12 different scores: (1) total score,

(2-6) part scores for Part I, II, III, IV, and V, (7) sub-score for the associative basis, (8) sub-score for the spatial basis, (9) sub-score for the mathematical basis, (10) sub-score for primary understanding, (11) sub-score for general understanding, and (12) sub-score for proficient understanding. These raw score data for the 12 scores were analyzed and the characteristics of these scores were computed as sub-tests. The test characteristics were examined for mean performance, patterns of dispersion, and reliability. The raw score data were also compared to measures of achievement, intelligence, and to one other measure of time understanding. This comparison was made to determine construct and concurrent validity. Content validity had been insured by test planning. Conclusions, based upon these data, were also possible about the nature of time understanding, and of the process of its development.

2. Conclusions

During the treatment of data achieved from the test analysis step of this investigation certain conclusions were reached involving the test instruments, the nature of the understanding of time, and the nature of time understanding itself. These conclusions would include the following points:

Test reliability.-- Both forms of the Test of Time Under-

standing were found to be reliable. The degree to which these instruments displayed differences within the learner, and development of skills is acceptable and determined to be useful for purposes of diagnosing an individual's achievement in this area, and for determining the presence or movement of time understanding within groups for curriculum foundation investigation.

Test validity.-- Both forms of the time understanding test were found to be valid from the point of view of three approaches to validity determination: (1) Content validity was assured by the sampling and planning procedures, supported by research, which produced a test including samples of words, systems, events, people, and combinations of these into test items evaluating deeper understanding of more complex time situations. (2) Construct validity was established by determining that the test of time understanding was not just a measure of general achievement, social studies skill, social studies information, arithmetic computation, arithmetic problem solving, or reading. The tests were found not to be just measures of intelligence. (3) Concurrent validity was established by locating a relationship with a previously constructed test of time understanding. Although a strong relationship was not found, an empirical approach to data treatment, considering

such factors as content, form, etc. allowed a concurrent validity to be established.

Uniqueness of measure.-- The various parts of the test of time understanding which had been planned in advance, were found to be unique when compared to each other. Separate and unique factors were evaluated. Individuals were shown to possess these different abilities to varying degrees. These differences justify the separation of these data as different indicators of potential ability or present success.

Tri-factored time understanding.-- The three bases of time understanding, i.e., associative, spatial, mathematical, provided data for sub-scores on each of the test forms. The information derived from a comparison of these results and sub-score distributions at the different grade levels proved that the three bases of time understanding are different, and are present within individuals to varying degrees. There is a development with the use of these bases, and an indication of maturity at a point where equal ability in the use of the bases would be found. Individuals at this mature level could select a basis of operation according to the occasion. The associative basis was found to be most difficult at the fourth grade level. The basis used with the greatest facility at this level was the mathematical. At the sixth grade level, although the use of

all bases had improved, the use of the spatial basis and associative basis had grown almost alike. A plateauing of difficulty and equality of ability to use these time understanding bases had been predicted, in the hypotheses, as parallel and progressive improvement throughout the grades, and shows that inter-relationship must be present as equality of operation is noted. This fact is noted in mature behavior at higher levels. Maturation, in this case, would be equal facility of use and operation with each, and all bases of time understanding.

Increased sophistication of today's children.-- Most of the research which is presently available in the field of time understanding indicates that children are not ready to be trained in the use of time, or in factors of time until late elementary school. Most of this research consists of status studies, measuring the product of experimental training programs. Based upon these data, the conclusions are sound. By logical development, however, it may be concluded that children in the fourth grade, or lower, are ready to be taught the use of time. They are ready to use this time understanding to build historical and social conceptualizations. Since children cannot deal with time until they can talk about it, we should examine the vocabulary of the child. A progressive improvement in the use of the vocabulary of time is noted in the data collected in this

test administration and analysis study. The fourth grader, however, started at a rather high level. If he can talk about time he should be able to use this factor in conceptual learning. Previous research indicates that this factor is not present at these school levels. Since an improvement is obviously noted, increased sophistication on the part of the child could be concluded. The fourth grader can use time lines, and interpret graphs. The fourth grader's ability improves as he moves to the fifth and sixth grade, but he already has some of the basic concepts formed. The school should use and broaden the concepts he has learned informally, and develop added concepts through the educational program. The fourth grader demonstrates a rudimentary grasp of the principles of operation within the area of abstract time understanding and of the understanding of time inter-relationships. According to previous research a grasp of these conceptual understandings was not present at this level. A note of its presence indicates growing sophistication. The factors which caused this growth or sophistication of operation may be theorized, but the scope of this investigation did not include plans to locate them.

Levels of understanding.-- The categorization of material within the test by levels of understanding was proven to be an adequate means of treating test data, and of classifying learn-

ing within an investigation of this sort. The progressive facility to use information, develop skill, and to interpret concepts and knowledge, was classified within three levels, i.e., primary, general, proficient. The test results indicated that the classification of growth factors within each of the elements of the test was valid. Children on the fourth grade level, for example, could cope with data on the primary level, but were less capable at the proficient level. This indicates that children do have rudimentary understandings and that these understandings do develop into proficient or mature understandings as they grow through the grades. As these levels of understanding, and bases of understanding grow there is every indication that they also become inter-related. This developmental theory is borne out by all of the test data collected during this study.

3. Educational Implications

The findings of this study should revise, and enlarge the views held today relative to time understanding as a factor in social studies learning. As a result of these findings many revisions of current practice should be possible. The implementation of programs which would benefit by the above conclusions may include the following:

Evaluation.-- There should be the use of a time understanding evaluation measure to diagnose student difficulties with social studies. If this time understanding factor is found to be lacking, the school should provide remedial teaching directed at this failure. An investigation of this sort would be particularly useful in cases where a lack of reading ability, or level of intelligence do not seem to be reasons for failure.

Time understanding bases.-- Social studies knowledge, which is time-related, should be presented to children by a teacher who is aware of the major time understanding basis which is needed to understand and use such knowledge. An approach to this knowledge within the framework of the needed basis would aid learning and make concept development a more lasting process. The teacher should also be aware of the involvement of other time understanding bases and encourage the inter-related development of learning using all bases of time understanding. Each basis will add a new dimension to learning. These factors should be included in the teacher's design of the learning situation.

Early teaching of time concepts.-- Social studies information and skill related to time understandings should be developed as early as the school program permits. The intended

learnings should be categorized and structured in terms of level of understanding, and in terms of a basis of time understanding. The development of these factors early in the program, utilizing the teaching techniques inferred in the description of each basis and level of understanding will develop a child more naturally in the area of social studies conceptual knowledge. This development takes advantage of the increased knowledge that the student evidently comes to school with, and takes advantage of the increased technical and artistic sophistication of learning development available for today's teachers.

Levels of knowledge.-- Levels of knowledge should be used as categories for knowledge and skill developed in the school. This would permit the early introduction of information and concept on a primary level and the use of this information, and these concepts, within the framework of primary understanding to aid in the growth of other skills and knowledges. Careful development of knowledge, so introduced, may be insured by step-wise teaching to the next level, commensurate with the growing ability of the child. In this way the power and joy of advanced concept may be enjoyed by translation to a level which matches the rudimentary capacity of the child. Development and growth would be similarly aided because of the logical development of learning and the learner occurring in consonance.

4. Recommendations for Further Study

The activities of this study, and the conclusions reached as a result of the data collection and analysis suggest other possible areas of study. Some of these other areas would include:

Reason for increased sophistication.-- There should be a determination of the factors which have caused the growth in sophistication, on the part of today's school children within this area of social studies learning. This investigation may conclude a manner of implementation for the development of defined factors within the educational program of today's schools.

Factor analysis of content.-- There should be a factor analysis of the content of the curriculum within social studies, and classification of learnings within the time understanding bases, and levels of knowledge included in this investigation. The findings of this type of an investigation would allow the placement, and evaluation of learnings at particular points within the school program. The classification of learnings by level of understanding would permit the discussion and use of conceptual knowledge at a much lower level. The teacher would be secure in the knowledge that the translation of a complex operation to a simplified form and use at a lower

level was valid and worthwhile.

Diagnostic applications.-- There should be a diagnostic scheme developed for the two instruments which have been constructed. This development could be performed by regression analysis. This analysis of relationship, and equating of performance, would permit the location of skill difficulty and prediction of the effect of remedial teaching.

Curriculum development.-- There should be the construction of a comprehensive curriculum for the development of time understanding, from the most basic, or rudimentary, to the most complex, or mature. This curricula design would include the particular concepts and skills that would be developed by the program. Implementation of such a program would enrich the present social studies programs, and insure adequate development of ideas and abilities known to be dependent upon time understanding.

APPENDICES

APPENDIX A

Included in this appendix are the two test forms constructed and administered during this study.

Test Form INT62 is intended for use with Grades 4, 5, and 6. Test Form JRH62 is intended for use with Grades 7 and 8.

Each test has five parts, i.e., (1) Part I, Vocabulary, (2) Part II, Knowledge of Time Systems and Relations, (3) Part III, Ability to Solve Time-oriented Problems, (4) Part IV, Abstract Time Relationships, and (5) Part V, Time Inter-relationships.

Each test has 80 multiple choice items with four distractors for each item.

A TEST OF TIME UNDERSTANDING

FORM INT62



January 1962

**C. L. JOHN LEGERE
136 South Street
Fitchburg, Mass.**

A TEST OF TIME UNDERSTANDINGDIRECTIONS

The following test questions were written to test your understanding of time. Some of the questions are about time words, some are about time systems, and some are about people and things in time. You should try your hardest to answer all of the questions correctly.

All of these questions have four possible answers. Read each question carefully, and choose the answer which you think is best. Circle this answer in the matching place on your answer card. The samples below show you what the questions will be like, and how to mark your answer card.

SAMPLE QUESTIONSTEST

1. The initials TV stand for
- A. total vision.
 - B. television.
 - C. tee vee.
 - D. tall vision.

ANSWER CARD

NAME _____											
1	2	3	4	5	6	7	8	9	10	11	12
0	0	0	0	0	0	0	0	0	0	0	0
A	A	A	A	A	A	A	A	A	A	A	A
<input checked="" type="radio"/>	B	B	B	B	B	B	B	B	B	B	B
C	C	C	C	C	C	C	C	C	C	C	C
D	D	D	D	D	D	D	D	D	D	D	D
41	42	43	44	45	46	47	48	49	50	51	52
0	0	0	0	0	0	0	0	0	0	0	0
A	A	A	A	A	A	A	A	A	A	A	A
B	B	B	B	B	B	B	B	B	B	B	B
C	C	C	C	C	C	C	C	C	C	C	C
D	D	D	D	D	D	D	D	D	D	D	D

Yes, TV stands for television. Since television is the "B" answer you would have circled the B under question 1. This is shown as it would appear on your answer card.

TURN THE PAGE AND TRY THE NEXT SAMPLE QUESTION. DO NOT MARK YOUR OWN ANSWER CARD, OR START THE TEST UNTIL YOUR TEACHER TELLS YOU TO.

2. Where do fish live?

- A. in the air
- B. in caves
- C. in the water
- D. on the ground

Yes, fish live in the water. Since this is the "C" answer you would have circled the C under question 2 on your answer card. This is shown as it would appear on your answer card. Try to keep the question number, and the letter of your choice in mind when you are marking the answer card.

TRY THE NEXT SAMPLE QUESTION.

3. Where do airplanes travel?

- A. on the ground
- B. under water
- C. on the water
- D. in the air

Yes, airplanes travel in the air. Since this is the "D" answer you would have circled the D under question 3. The sample answer card shows how this would appear. If you must change an answer, you need not erase. Make your change by putting an X through the wrong one. Item 4 shows this as it would be done.

IF YOU STILL HAVE QUESTIONS ABOUT HOW TO PUT YOUR ANSWERS DOWN ON THE ANSWER CARD - - - ASK YOUR TEACHER. THE TEACHER WILL TELL YOU HOW. THE TEACHER WILL NOT, HOWEVER, ANSWER QUESTIONS ABOUT WHAT THE ANSWERS TO QUESTIONS ARE. DO NOT START THE TEST UNTIL THE TEACHER TELLS YOU TO.

DO NOT WRITE IN THE TEST BOOKLET

NAME _____											
1	2	3	4	5	6	7	8	9	10	11	
0	0	0	0	0	0	0	0	0	0	0	
A	A	A	X	A	A	A	A	A	A	A	
<input type="radio"/> B	B	B	B	B	B	B	B	B	B	B	
C	<input type="radio"/> C	<input type="radio"/> C	C	C	C	C	C	C	C	C	
D	D	<input type="radio"/> D	D	D	D	D	D	D	D	D	
41	42	43	44	45	46	47	48	49	50	51	52
0	0	0	0	0	0	0	0	0	0	0	0
A	A	A	A	A	A	A	A	A	A	A	A
B	B	B	B	B	B	B	B	B	B	B	B
C	C	C	C	C	C	C	C	C	C	C	C
D	D	D	D	D	D	D	D	D	D	D	D

PART I--VOCABULARY

1. By using the word **SOMETIME**, when do we say something has happened?
 - A. past
 - B. present
 - C. future
 - D. no particular time

2. By using the word **RECENTLY**, when do we say something has happened?
 - A. past
 - B. present
 - C. future
 - D. no particular time

3. **TOMORROW** is the day
 - A. before today.
 - B. before yesterday.
 - C. after today.
 - D. after yesterday.

4. **TONIGHT** is a word we use if something happens
 - A. long ago.
 - B. not long ago.
 - C. now.
 - D. in the future.

5. **THEN** is a word we use if something happens
 - A. long ago.
 - B. not long ago.
 - C. now.
 - D. in the future.

6. **SOON** is a word we use if something happens
 - A. long ago.
 - B. not long ago.
 - C. now.
 - D. in the future.

7. RIGHT AWAY are words we use if something happens
- A. long ago.
 - B. not long ago.
 - C. now.
 - D. in the future.
8. Three words which all have to do with things that have not happened yet are
- A. next, future, soon.
 - B. future, before, now.
 - C. before, now, till.
 - D. before, ago, last.
9. If we wanted to tell about the time before Christ, we would use the word
- A. modern.
 - B. colonial.
 - C. ancient.
 - D. antique.
10. NEXT is a word we use if something happens
- A. long ago.
 - B. not long ago.
 - C. now.
 - D. in the future.
11. IMMEDIATELY is a word we use if something happens
- A. long ago.
 - B. not long ago.
 - C. now.
 - D. in the future.
12. BY AND BY are words we use if something happens
- A. long ago.
 - B. not long ago.
 - C. now.
 - D. in the future.

13. **BEFORE** is a word we use if something happens
- A. long ago.
 - B. not long ago.
 - C. now.
 - D. in the future.
14. **AGAIN** is a word we use if something happens
- A. long ago.
 - B. not long ago.
 - C. now.
 - D. in the future.
15. **AFTER** is a word we use if something happens
- A. long ago.
 - B. not long ago.
 - C. now.
 - D. in the future.
16. Three words which all have to do with things that have happened already are
- A. today, tomorrow, next.
 - B. past, ago, now.
 - C. ago, before, tomorrow.
 - D. ago, before, past.
17. The **MODERN** period of time is when
- A. Columbus lived.
 - B. Washington lived.
 - C. cave men lived.
 - D. we are living.
18. **SUMMER** is the season between
- A. winter and spring.
 - B. spring and winter.
 - C. winter and fall.
 - D. fall and spring.

19. When we use the word **CENTURY** we mean

- A. 10 years.
- B. 100 years.
- C. 1000 years.
- D. 10000 years.

20. **AUTUMN** is the season which comes between

- A. summer and spring.
- B. spring and winter.
- C. winter and summer.
- D. summer and winter.

21. Which word means the same as **PRESENT**?

- A. again.
- B. now.
- C. past.
- D. until.

22. Which list of words is in the correct order from past to present?

- A. ago, last, today, next.
- B. ago, today, last, next.
- C. next, today, last, ago.
- D. today, last, next, ago.

23. Often we read that **TIME STOOD STILL** in a place. What does this mean?

- A. the clocks did not work
- B. things did not change
- C. there was no motion
- D. people lived forever

24. The letters A.M. after a time mean that the time is
- A. between midnight and noon.
 - B. between noon and midnight.
 - C. between breakfast and lunch.
 - D. between lunch and dinner.
25. The letters P.M. after a time mean that the time is
- A. between midnight and noon.
 - B. between noon and midnight.
 - C. between breakfast and lunch.
 - D. between lunch and dinner.
26. The months which have 30 days are
- A. October, April, June, and November.
 - B. November, April, June, and October.
 - C. September, April, June, and November.
 - D. December, April, June, and October.
27. The number of seconds in 6 hours is
- A. 360.
 - B. 3600.
 - C. 21600.
 - D. 216000.
28. Saturday is the day after
- A. Sunday.
 - B. Thursday.
 - C. Friday.
 - D. Tuesday.
29. Wednesday is the day after
- A. Tuesday.
 - B. Friday.
 - C. Thursday.
 - D. Monday.









30. When we say 3:00 A.M. we mean
- A. 3 o'clock in the afternoon.
 - B. 3 o'clock in the morning.
 - C. 3 o'clock after the morning.
 - D. 3 o'clock afternoon or morning.
31. To tell that we would be someplace 2 hours after noon time we would say
- A. 2 P.M.
 - B. 2 A.M.
 - C. 10 A.M.
 - D. 10 P.M.
32. The number of minutes in one half hour is
- A. twenty.
 - B. thirty.
 - C. forty.
 - D. sixty.
33. The number of seconds in three hours is
- A. 180.
 - B. 1080.
 - C. 10800.
 - D. 180000.
34. The period of time we are now living in is called the
- A. 18th century.
 - B. 19th century.
 - C. 20th century.
 - D. 21st century.
35. How many days are in one year?
- A. 465
 - B. 425
 - C. 365
 - D. 325

36. How many days are in one week?
- A. 17
 - B. 12
 - C. 14
 - D. 7

37. How many seconds are in one minute?
- A. 120
 - B. 100
 - C. 80
 - D. 60

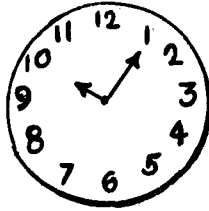
38. How many minutes are in one hour?
- A. 120
 - B. 100
 - C. 80
 - D. 60

QUESTIONS 39 AND 40 REFER TO THE CALENDAR SHOWN BELOW

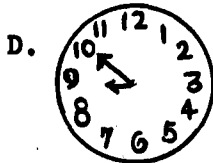
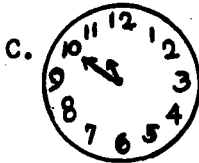
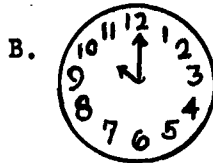
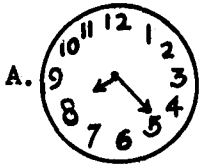
S	M	T	W	T	F	S
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7	8	9 	10	11 	12	13
14	15	16	17	18 	19	20
21	22 	23	24	25 	26	27
28	29	30	31	32 		

39. The calendar must be for
- A. June.
 - B. October.
 - C. February.
 - D. no month.
40. The number of different kinds of mistakes which can be found on the calendar is
- A. 1.
 - B. 2.
 - C. 3.
 - D. 4.

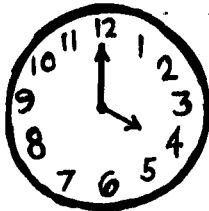
QUESTION 41 REFERS TO THE CLOCK WHICH IS SHOWN BELOW



41. Which clock would show what time it would be 45 minutes after the time shown on the clock above?



QUESTION 42 REFERS TO THE CLOCK SHOWN BELOW



42. The clock shows that it is

- A. 12:25 P.M.
- B. 11:25 A.M.
- C. 4:00 P.M.
- D. 5:00 P.M.

43. Between ten in the morning and ten at night, the hour hand has gone around the face of the clock once. How many times has the minute hand gone around?

- A. 3
- B. 6
- C. 9
- D. 12

QUESTION 44 REFERS TO THE CLOCK SHOWN BELOW



44. The clock shows that it is
- A. 6 o'clock.
 - B. 12 o'clock.
 - C. half past six.
 - D. half-past twelve.

QUESTION 45 REFERS TO THE CLOCK SHOWN BELOW



45. The clock shows that it is
- A. 8:00 A.M.
 - B. 8:00 P.M.
 - C. 11:40 A.M.
 - D. none of these.

PART III - - ABILITY TO SOLVE TIME ORIENTED PROBLEMS

46. The number of hours from eleven at night until one in the morning is
- A. one.
 - B. two.
 - C. nine.
 - D. ten.
47. The amount of time from the dawn of one day until the dawn of the next day is
- A. 8 hours.
 - B. 12 hours.
 - C. 16 hours.
 - D. 24 hours.

48. Some of the Egyptian pyramids were built in 3300 B.C. How many years was this before 1960?
- A. 3300
 - B. 3360
 - C. 5260
 - D. 1340
49. One day is the time it takes the earth to
- A. travel around the sun.
 - B. turn once on its own axis.
 - C. travel around the moon.
 - D. turn away from the moon.
50. When the sun is rising in New York City, on the Atlantic Ocean, what is the sun doing in San Francisco, on the Pacific Ocean?
- A. The sun has been up for about three hours.
 - B. The sun will rise in about three hours.
 - C. The sun set about three hours ago.
 - D. The sun will set in about three hours.
51. The seasons, Fall, Winter, Summer, and Spring are caused by the earth's
- A. rotation and revolution.
 - B. rotation and inclination.
 - C. revolution and inclination.
 - D. rotation and axis.
52. Which trip would take longest to complete?
- A. from Boston to San Francisco in 1848
 - B. from England to Plymouth, Mass. in 1620
 - C. from New York to Chicago in 1920
 - D. from New York to Tokyo, Japan in 1961
53. A man earns \$2.23 per hour. How much money would he earn in $3\frac{1}{2}$ hours?
- A. \$4.46
 - B. \$9.69
 - C. \$7.81
 - D. \$8.81

54. If a man works for 30 minutes, and makes \$4.00, what is his hourly rate of pay?
- A. \$2.00
 - B. \$4.00
 - C. \$6.00
 - D. \$8.00
55. The nearest star is four light years from the earth. Which statement is true concerning the light we see from that star?
- A. It will remain bright for four years.
 - B. It has taken four years to get to the earth.
 - C. It will travel for four more years.
 - D. It will return in four years.

PART IV - - ABSTRACT TIME RELATIONSHIPS

56. Which newspaper headline would not be possible?
- A. WASHINGTON AND FRANKLIN MEET IN PHILADELPHIA
 - B. HITLER AND STALIN MEET IN BERLIN
 - C. ROOSEVELT AND LINCOLN MEET IN ILLINOIS
 - D. KENNEDY AND MACARTHUR MEET IN MANILA
57. The War of 1812 was fought
- A. between Lincoln and 1900.
 - B. between Washington and 1850.
 - C. between Roosevelt and 1950.
 - D. between Christ and 1500.
58. When was the time of the Crusades?
- A. between Lincoln and 1900.
 - B. between Washington and 1850.
 - C. between Roosevelt and 1950
 - D. between Christ and 1500
59. When was the first automobile driven?
- A. between Lincoln and 1900
 - B. between Washington and 1850
 - C. between Roosevelt and 1950
 - D. between Christ and 1500

60. When did the Pilgrims land at Plymouth?

- A. about 50 years ago
- B. about 150 years ago
- C. about 250 years ago
- D. about 350 years ago

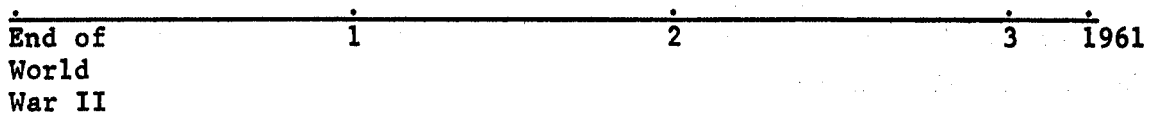
61. When was the Civil War fought?

- A. about 10 years ago
- B. about 50 years ago
- C. about 100 years ago
- D. about 500 years ago

62. When was the first airplane flown?

- A. about 10 years ago
- B. about 50 years ago
- C. about 100 years ago
- D. about 500 years ago

QUESTIONS 63 AND 64 REFER TO THE FOLLOWING TIME LINE



63. Which event could have happened at Point 1 on the time line?

- A. Linbergh crosses the Atlantic (1927)
- B. Korean Conflict (1950)
- C. Atomic Bomb is dropped for the first time (1945)
- D. Roosevelt is elected for a fourth term (1944)

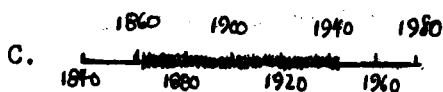
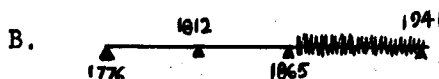
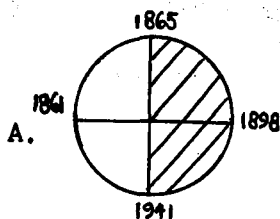
64. Which event could have happened at Point 3 on the time line?

- A. Korean Conflict (1950)
- B. Atomic Bomb is dropped for the first time (1945)
- C. Roosevelt is elected for the fourth term (1944)
- D. Kennedy is elected for the first time (1960)

QUESTION 65 REFERS TO THE FOLLOWING TIME LINE

3300 B.C. _____ 1960

65. The history of the United States would fill what part of this time line?
- A. one half
B. one twentieth
C. one tenth
D. one fortieth
66. The Civil War was fought between 1861 and 1865. Which illustration shows the period of time between the Civil War and World War II most accurately?



PART V - - TIME INTER-RELATIONSHIPS

67. Which saying was used the longest time ago?
- A. REMEMBER THE ALAMO!
B. REMEMBER THE MAINE!
C. REMEMBER PEARL HARBOR!
D. REMEMBER THE DEPRESSION!
68. The invention of the automobile made the greatest change in
- A. the westward movement.
B. the Spanish American War.
C. mass production.
D. all of the above.

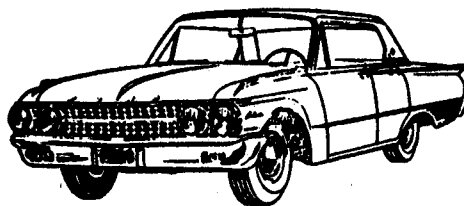
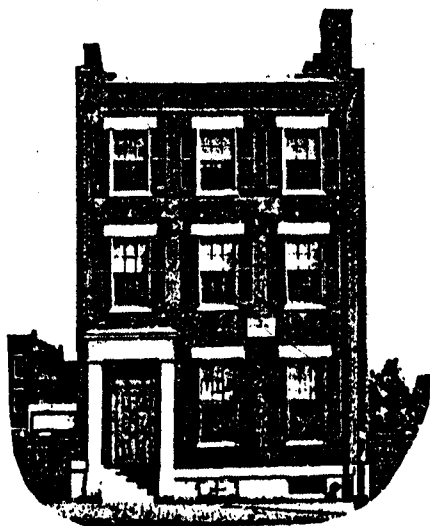
QUESTIONS 69 TO 72 REFER TO THE FOLLOWING PARAGRAPH

In 1848, gold was discovered in California. Many other important events have happened in the United States before that time, and after that time. The questions which follow are about some of these events.

69. Henry Ford built a low priced automobile
- A. before gold was discovered in California.
 - B. at the same time that gold was discovered in California.
 - C. shortly after gold was discovered in California.
 - D. more than 20 years after gold was discovered in California.
70. Samuel F. B. Morse sent the first telegraphic message
- A. before gold was discovered in California.
 - B. at the same time that gold was discovered in California.
 - C. shortly after gold was discovered in California.
 - D. more than 20 years after gold was discovered in California.
71. Eli Whitney invented the cotton gin
- A. before gold was discovered in California.
 - B. at the same time that gold was discovered in California.
 - C. shortly after gold was discovered in California.
 - D. more than 20 years after gold was discovered in California.
72. The Southern States formed the Confederacy
- A. before gold was discovered in California.
 - B. at the same time that gold was discovered in California.
 - C. shortly after gold was discovered in California.
 - D. more than 20 years after gold was discovered in California.
73. Which events had the longest space of time between them?
- A. Civil War and Spanish American War
 - B. Civil War and World War
 - C. Revolutionary War and Civil War
 - D. World War I and World War II

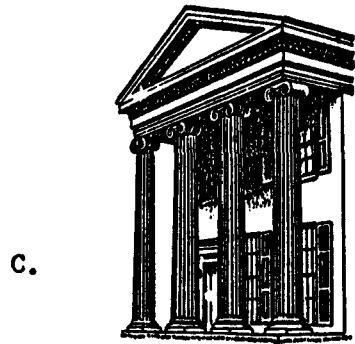
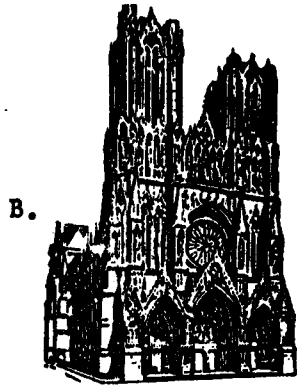
74. The things which we see in a museum that were used in 1900 could have been used, at that time, by
- A. you.
 - B. your Father, as a boy.
 - C. your Grandfather, as a boy.
 - D. your Great-grandfather, as a boy.

QUESTION 75 REFERS TO THE FOLLOWING PICTURES

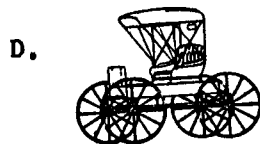
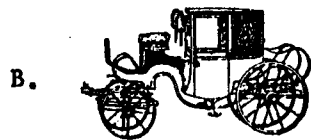
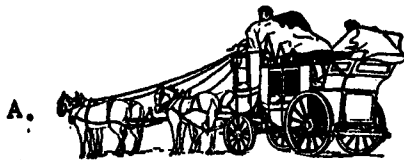


75. Which of the things pictured above were most likely built during the same year?
- A. plane and car
 - B. building and car
 - C. building and plane
 - D. building, plane, and car

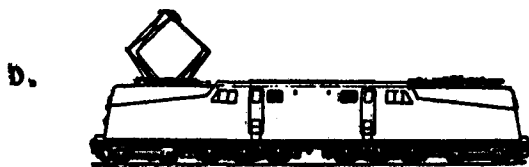
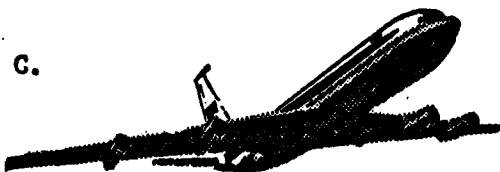
76. Which building is oldest?



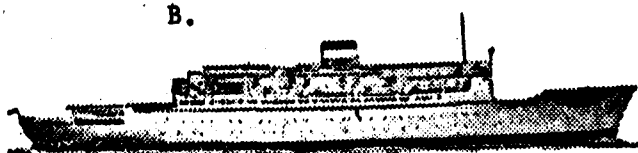
77. Which example of different forms of transportation is oldest?



78. Which example of different forms of transportation was built most recently?



79. Which example of different forms of transportation was used the longest time ago?



80. Which example of different forms of dress is most up-to-date?

A.



C.



B.



D.



A TEST OF TIME UNDERSTANDING

FORM JRH62



JANUARY 1962

C. L. JOHN LEGERE
136 South Street
Fitchburg, Mass.

A TEST OF TIME UNDERSTANDINGDIRECTIONS

The following test questions were written to test your understanding of time. Some of the questions are about time words, some are about time systems, and some are about people and things in time. You should try your hardest to answer all of the questions correctly.

All of these questions have four possible answers. Read each question carefully, and choose the answer which you think is best. Circle this answer in the matching place on your answer card. The samples below show you what the questions will be like, and how to mark your answer card.

SAMPLE QUESTIONSTEST

1. The initials TV stand for
- A. total vision.
 - B. television.
 - C. tee vee.
 - D. tall vision.

ANSWER CARD

NAME											
1	2	3	4	5	6	7	8	9	10	11	12
O	O	O	O	O	O	O	O	O	O	O	O
A	A	A	A	A	A	A	A	A	A	A	A
<input checked="" type="radio"/> B	B	B	B	B	B	B	B	B	B	B	B
C	C	C	C	C	C	C	C	C	C	C	C
D	D	D	D	D	D	D	D	D	D	D	D
41	42	43	44	45	46	47	48	49	50	51	52
O	O	O	O	O	O	O	O	O	O	O	O
A	A	A	A	A	A	A	A	A	A	A	A
B	B	B	B	B	B	B	B	B	B	B	B
C	C	C	C	C	C	C	C	C	C	C	C
D	D	D	D	D	D	D	D	D	D	D	D

Yes, TV stands for television. Since television is the "B" answer you would have circled the B under question 1. This is shown as it would appear on your answer card.

TURN THE PAGE AND TRY THE NEXT SAMPLE QUESTION. DO NOT MARK YOUR OWN ANSWER CARD, OR START THE TEST UNTIL YOUR TEACHER TELLS YOU TO.

2. Where do fish live?

- A. in the air
- B. in caves
- C. in the water
- D. on the ground

Yes, fish live in the water. Since this is the "C" answer you would have circled the C under question 2 on your answer card. This is shown as it would appear on your answer card. Try to keep the question number, and the letter of your choice in mind when you are marking the answer card.

TRY THE NEXT SAMPLE QUESTION.

3. Where do airplanes travel?

- A. on the ground
- B. under water
- C. on the water
- D. in the air

Yes, airplanes travel in the air. Since this is the "D" answer you would have circled the D under question 3. The sample answer card shows how this would appear. If you must change an answer, you need not erase. Make your change by putting an X through the wrong one. Item 4 shows this as it would be done.

IF YOU STILL HAVE QUESTIONS ABOUT HOW TO PUT YOUR ANSWERS DOWN ON THE ANSWER CARD - - - ASK YOUR TEACHER. THE TEACHER WILL TELL YOU HOW. THE TEACHER WILL NOT, HOWEVER, ANSWER QUESTIONS ABOUT WHAT THE ANSWERS TO QUESTIONS ARE. DO NOT START THE TEST UNTIL THE TEACHER TELLS YOU TO.

DO NOT WRITE IN THE TEST BOOKLET

NAME										
1	2	3	4	5	6	7	8	9	10	11
0	0	0	0	0	0	0	0	0	0	0
A	A	A	X	A	A	A	A	A	A	A
B	B	B	B	B	B	B	B	B	B	B
C	C	C	C	C	C	C	C	C	C	C
D	D	D	D	D	D	D	D	D	D	D
41	42	43	44	45	46	47	48	49	50	51
0	0	0	0	0	0	0	0	0	0	0
A	A	A	A	A	A	A	A	A	A	A
B	B	B	B	B	B	B	B	B	B	B
C	C	C	C	C	C	C	C	C	C	C
D	D	D	D	D	D	D	D	D	D	D

PART I - - VOCABULARY

1. Which list of words is in the correct order from past to present?
 - A. ago, last, today, next.
 - B. ago, today, last, next.
 - C. next, today, last, ago.
 - D. today, last, next, ago.

2. What is the meaning of the word TIMES when it is used as a title for a newspaper? (New York Times, London Times, etc.)
 - A. It means that the paper is published at regular times.
 - B. It means that the paper is a report of what has happened during this time.
 - C. It means that the paper comes out a number of times a year.
 - D. It means that the paper multiplies your knowledge.

3. Often we read that TIME STOOD STILL in a place. What does this mean?
 - A. the clocks did not work
 - B. things did not change
 - C. there was no motion
 - D. people lived forever

4. The word "score" as Lincoln used it in the Gettysburg Address means
 - A. 10 years.
 - B. 20 years.
 - C. 30 years.
 - D. 40 years.

5. Three words which all have to do with things that have happened already are
 - A. today, tomorrow, next.
 - B. past, ago, now.
 - C. ago, before, tomorrow.
 - D. ago, before, past.

6. If we wanted to tell about the time before Christ, we would use the word
 - A. modern.
 - B. colonial.
 - C. ancient.
 - D. antique.

7. By using the word **RECENTLY**, when do we say something has happened?
- A. past
 - B. present
 - C. future
 - D. no particular time
8. **SOON** is a word we use if something happens
- A. long ago.
 - B. not long ago.
 - C. now.
 - D. in the future.
9. Three words which all have to do with things that have not happened yet are
- A. next, future, soon.
 - B. future, before, now.
 - C. before, now, till.
 - D. before, ago, last.
10. When we use the word **CENTURY** we mean
- A. 10 years.
 - B. 100 years.
 - C. 1000 years.
 - D. 10000 years.
11. **AUTUMN** is the season which comes between
- A. summer and spring.
 - B. spring and winter.
 - C. winter and summer.
 - D. summer and winter.
12. **SUMMER** is the season which comes between
- A. winter and spring.
 - B. spring and winter.
 - C. winter and fall.
 - D. fall and spring.

13. When we use the word **DECADE** we mean
- A. 1 year.
 - B. 10 years.
 - C. 100 years.
 - D. 1000 years.
14. If we wanted to tell about the time of the Pilgrims we would use the word
- A. modern.
 - B. colonial.
 - C. ancient.
 - D. antique.
15. When we use the word **PREHISTORIC** we mean
- A. before recorded history.
 - B. after recorded history.
 - C. during recorded history.
 - D. a record of history.
16. The **MODERN** period of time is when
- A. Columbus lived.
 - B. Washington lived.
 - C. cave men lived.
 - D. we are living.
17. Which word means the same as **PRESENT**?
- A. again
 - B. now
 - C. past
 - D. until
18. **IMMEDIATELY** is a word we use if something happens
- A. long ago.
 - B. not long ago.
 - C. now.
 - D. in the future.









19. NEXT is a word we use if something happens
- A. long ago.
 - B. not long ago.
 - C. now.
 - D. in the future.
20. When we use the word SEMIANNUAL we mean something that happens every
- A. year.
 - B. half year.
 - C. quarter year.
 - D. two years.

PART II -- KNOWLEDGE OF TIME SYSTEMS AND RELATIONS

21. The letters A. M. after a time mean that the time is
- A. between midnight and noon.
 - B. between noon and midnight.
 - C. between breakfast and lunch.
 - D. between lunch and dinner.
22. The letters P. M. after a time mean that the time is
- A. between midnight and noon.
 - B. between noon and midnight.
 - C. between breakfast and lunch.
 - D. between lunch and dinner.
23. The months which have 30 days are
- A. October, April, June, and November.
 - B. November, April, June, and October.
 - C. September, April, June, and November.
 - D. December, April, June, and October.
24. The period of time we are now living in is called the
- A. 18th century.
 - B. 19th century.
 - C. 20th century.
 - D. 21st century.
- 6

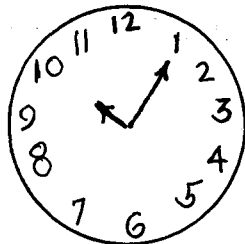
25. Between ten in the morning and ten at night, the hour hand has gone around the face of the clock once. How many times has the minute hand gone around?
- A. 3
 - B. 6
 - C. 9
 - D. 12
26. Which period of time is longest?
- A. light year
 - B. millenium
 - C. decade
 - D. century
27. A sundial may be used as a clock because it
- A. has evenly spaced numbers on it.
 - B. follows the sun.
 - C. has numbers to mark the size and direction of a shadow as the sun moves.
 - D. has an exposure to the sun which causes the base of the sundial to move during the day.
28. What is meant by the date 1961?
- A. One thousand nine hundred and sixty years
 - B. One thousand nine hundred and sixty one years since the beginning of America
 - C. One thousand nine hundred and sixty one years since the beginning of Europe
 - D. One thousand nine hundred and sixty one years since the birth of Christ
29. When we say 8:00 A. M. we mean
- A. 8 o'clock in the evening.
 - B. 8 o'clock in the morning.
 - C. 8 o'clock after the morning.
 - D. 8 o'clock afternoon or morning.

QUESTIONS 30 AND 31 REFER TO THE CALENDAR SHOWN BELOW

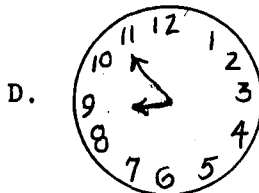
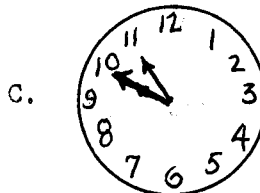
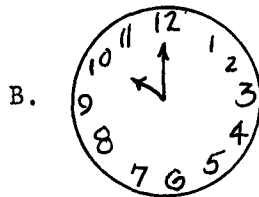
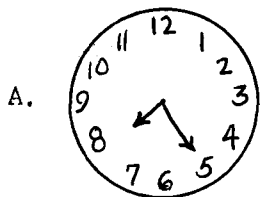
S	M	T	W	T	F	S
	1 	2	3	4 	5	6
7	8	9 	10	11 	12	13
14	15	16	17	18 	19	20
21	22	23 	24	25 	26	27
28	29	30	31	32 		

30. The calendar must be for
- June.
 - October.
 - February.
 - no month.
31. The number of different kinds of mistakes which can be found on the calendar is
- 1.
 - 2.
 - 3.
 - 4.
32. The number of seconds in 6 hours is
- 360.
 - 3600.
 - 21600.
 - 216000.

QUESTION 33 REFERS TO THE CLOCK WHICH IS SHOWN BELOW



33. Which clock would show what time it would be 45 minutes after the time shown on the clock above?



34. To tell that we would be someplace 2 hours after noon time we would say

- A. 2 P. M.
- B. 2 A. M.
- C. 10 A. M.
- D. 10 P. M.

35. How many days are in one year?

- A. 465
- B. 425
- C. 365
- D. 325

PART III -- ABILITY TO SOLVE TIME ORIENTED PROBLEMS

36. The number of hours from eleven at night until one in the morning is
- A. one.
 - B. two.
 - C. nine.
 - D. ten.
37. The amount of time from the dawn of one day until the dawn of the next day is
- A. 8 hours.
 - B. 12 hours.
 - C. 16 hours.
 - D. 24 hours.
38. Some of the Egyptian pyramids were built in 3300 B.C. How many years was this before 1960?
- A. 3300
 - B. 3360
 - C. 5260
 - D. 1340
39. One day is the time it takes the earth to
- A. travel around the sun.
 - B. turn once on its axis.
 - C. travel around the moon.
 - D. turn away from the moon.
40. When the sun is rising in New York City, on the Atlantic Ocean, what is the sun doing in San Francisco, on the Pacific Ocean?
- A. The sun has been up for about three hours.
 - B. The sun will rise in about three hours.
 - C. The sun set about three hours ago.
 - D. The sun will set in about three hours.

41. The seasons, Fall, Winter, Summer, and Spring are caused by the earth's
- A. rotation and revolution.
 - B. rotation and inclination.
 - C. revolution and inclination.
 - D. rotation and axis.
42. Which trip would take longest to complete?
- A. from Boston to San Francisco in 1848
 - B. from England to Plymouth, Mass. in 1620
 - C. from New York to Chicago in 1920
 - D. from New York to Tokyo, Japan in 1961
43. A man earns \$2.23 per hour. How much money would he earn in $3\frac{1}{2}$ hours?
- A. \$4.46
 - B. \$9.69
 - C. \$7.81
 - D. \$8.81
44. If a man works for 30 minutes, and makes \$4.00, what is his hourly rate of pay?
- A. \$2.00
 - B. \$4.00
 - C. \$6.00
 - D. \$8.00
45. The nearest star is four light years from the earth. Which statement is true concerning the light we see from that star?
- A. It will remain bright for four years.
 - B. It has taken four years to get to the earth.
 - C. It will travel for four more years.
 - D. It will return in four years.

PART IV - - ABSTRACT TIME RELATIONSHIPS

46. The War of 1812 was fought
- A. between Lincoln and 1900.
 - B. between Washington and 1850.
 - C. between Roosevelt and 1950.
 - D. between Christ and 1500.
47. When was the time of the Crusades?
- A. between Lincoln and 1900
 - B. between Washington and 1850
 - C. between Roosevelt and 1950
 - D. between Christ and 1500
48. When was the Spanish American War fought?
- A. between Lincoln and 1900
 - B. between Washington and 1850
 - C. between Roosevelt and 1950
 - D. between Christ and 1500
49. When was the first automobile driven?
- A. between Lincoln and 1900
 - B. between Washington and 1850
 - C. between Roosevelt and 1950
 - D. between Christ and 1500
50. When did the Pilgrims land at Plymouth?
- A. about 50 years ago
 - B. about 150 years ago
 - C. about 250 years ago
 - D. about 350 years ago
51. When was the Korean Conflict fought?
- A. about 10 years ago
 - B. about 50 years ago
 - C. about 100 years ago
 - D. about 500 years ago

52. When was the Civil War fought?

- A. about 10 years ago
- B. about 50 years ago
- C. about 100 years ago
- D. about 500 years ago

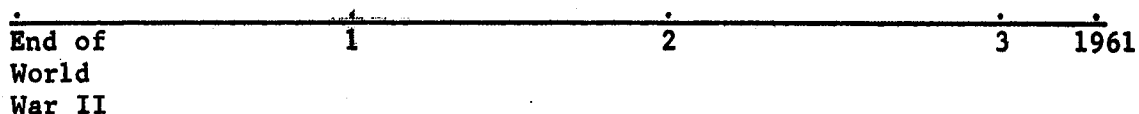
53. When was the first airplane flown?

- A. about 10 years ago
- B. about 50 years ago
- C. about 100 years ago
- D. about 500 years ago

54. When was the Boston Tea Party?

- A. about 100 years ago
- B. about 200 years ago
- C. about 300 years ago
- D. about 400 years ago

QUESTIONS 55 AND 56 REFER TO THE FOLLOWING TIME LINE



55. Which event could have happened at Point 1 on the time line?

- A. Lindbergh crosses the Atlantic
- B. Korean Conflict
- C. Atomic Bomb is dropped for the first time
- D. Roosevelt is elected for a fourth term

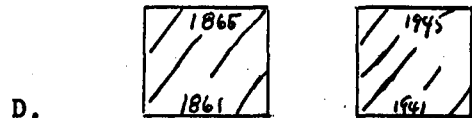
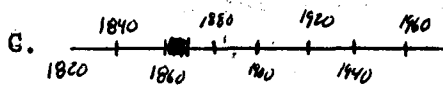
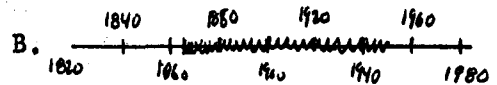
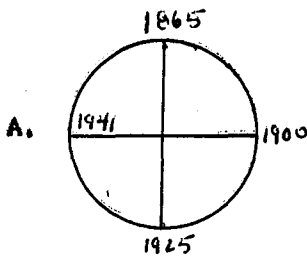
56. Which event could have happened at Point 3 on the time line?

- A. Korean Conflict
- B. Atomic Bomb is dropped for the first time
- C. Roosevelt is elected for a fourth term
- D. Kennedy is elected for the first time

QUESTION 57 REFERS TO THE FOLLOWING TIME LINE

3300 B.C. _____ 1960

57. The history of the United States would fill what part of this time line?
- A. one half
B. one twentieth
C. one tenth
D. one fortieth
58. Which illustration shows the period of time between the Civil War and World War II most accurately?



59. Which person became famous less than 100 years ago?
- A. Lafayette
B. Jefferson
C. Lincoln
D. Custer

60. Which list of events is in the correct order?

- A. Civil War, Gold Rush, Spanish American War, First Plane Flight
B. Gold Rush, Spanish American War, First Plane Flight, Civil War
C. Gold Rush, Civil War, Spanish American War, First Plane Flight
D. Spanish American War, Civil War, Gold Rush, First Plane Flight

PART V -- TIME INTER-RELATIONSHIPS

61. Which saying was used the longest time ago?
- A. REMEMBER THE ALAMO!
 - B. REMEMBER THE MAINE!
 - C. REMEMBER PEARL HARBOR!
 - D. REMEMBER THE DEPRESSION!
62. The things that we see in a museum which were used in 1900 could have been used, at that time, by
- A. you.
 - B. your Father, as a boy.
 - C. your Grandfather, as a boy.
 - D. your Great-grandfather, as a boy.

QUESTIONS 63 TO 66 REFER TO THE FOLLOWING PARAGRAPH

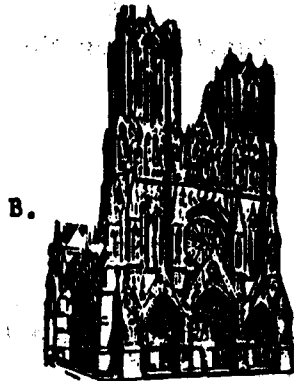
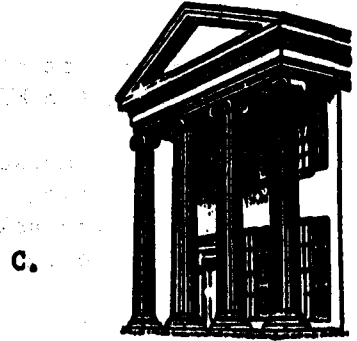
In 1848, gold was discovered in California. Many other important events have occurred in the United States before that time, and after that time. The questions which follow are about some of these events.

63. Henry Ford built a low priced automobile
- A. before gold was discovered in California.
 - B. at the same time that gold was discovered in California.
 - C. shortly after gold was discovered in California.
 - D. more than 20 years after gold was discovered in California.
64. Samuel F. B. Morse sent the first telegraphic message
- A. before gold was discovered in California.
 - B. at the same time that gold was discovered in California.
 - C. shortly after gold was discovered in California.
 - D. more than 20 years after gold was discovered in California.
65. Eli Whitney invented the cotton gin
- A. before gold was discovered in California.
 - B. at the same time that gold was discovered in California.
 - C. shortly after gold was discovered in California.
 - D. more than 20 years after gold was discovered in California.

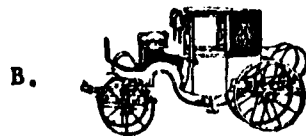
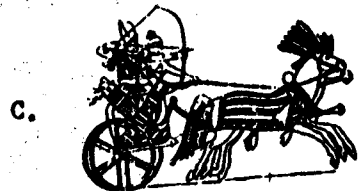
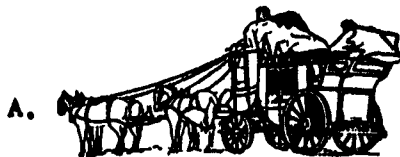
66. The Southern States formed the Confederacy
- A. before gold was discovered in California.
 - B. at the same time that gold was discovered in California.
 - C. shortly after gold was discovered in California.
 - D. more than 20 years after gold was discovered in California.
67. Which events had the longest space of time between them?
- A. Civil War and Spanish American War
 - B. Civil War and World War I
 - C. Revolutionary War and Civil War
 - D. World War I and World War II
68. The invention of the automobile most affected
- A. the westward movement.
 - B. the Spanish American War.
 - C. mass production.
 - D. all of the above.
69. The invention of the cotton gin probably affected
- A. slavery problems.
 - B. the industrial revolution.
 - C. the clothing industry.
 - D. all of the above.
70. Which person and event is matched correctly?
- A. Roosevelt and World War I
 - B. Lincoln and the Spanish American War
 - C. Grant and the Civil War
 - D. Washington and the Boxer Rebellion
71. Which people had the longest space of time between them?
- A. Roosevelt and Kennedy
 - B. Washington and Lincoln
 - C. Hoover and Wilson
 - D. Ford and Edison

72. Which mode of transportation is an example of the travel during the Middle Ages?
- A. stagecoach
 - B. chariot
 - C. horseback
 - D. gondola
73. Which type of a building was built during the Medieval period of time?
- A. pyramid
 - B. castle
 - C. obelisk
 - D. tent
74. The necessity for regular mail delivery made the greatest change in the development of the
- A. stagecoach.
 - B. Pony Express.
 - C. railroad.
 - D. automobile.
75. Christopher Columbus and George Washington lived during different periods of time. How far apart were these periods of time?
- A. about 100 years
 - B. about 200 years
 - C. about 300 years
 - D. about 400 years

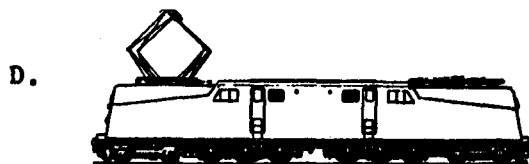
76. Which building is oldest?



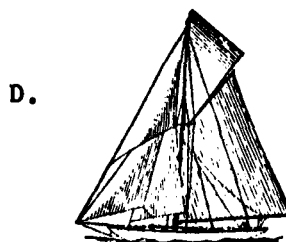
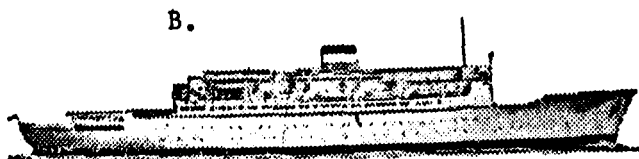
77. Which example of different forms of transportation is oldest?



78. Which example of different forms of transportation was built most recently?



79. Which example of different forms of transportation was used the longest time ago?



80. Which example of different forms of dress is most up-to-date?

A.



C.



B.



D.

