1976

An investigation of eighth grade pupils' understanding of quantitative concepts from United States history textbooks

Harold Lee Bush

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AN INVESTIGATION OF EIGHTH GRADE PUPILS'
UNDERSTANDING OF QUANTITATIVE CONCEPTS
FROM UNITED STATES HISTORY TEXTBOOKS

A Dissertation
Presented to
the Faculty of the School of Education
the University of the Pacific

In Partial Fulfillment
of the Requirement for the Degree
Doctor of Education

by
Harold L. Bush
Spring 1976
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AN INVESTIGATION OF EIGHTH GRADE PUPILS' UNDERSTANDING OF QUANTITATIVE CONCEPTS FROM UNITED STATES HISTORY TEXTBOOKS

ABSTRACT OF DISSERTATION

PROBLEM: The problem of this study is to determine the extent to which eighth grade students understand quantitative concepts expressed in United States History textbooks.

PURPOSE: This investigation was conducted to explore the types of quantitative concepts found in eighth grade United States History textbooks, the students' understanding of these concepts, and the relationship between their understanding of these concepts and the variables of math achievement, reading achievement, and grade point average.

PROCEDURES: Two hundred sixty-three students from twelve eighth grade classes in three neighboring school districts were given a Test on Quantitative Concepts designed by the investigator. The students were divided into three groups: those using a United States History textbook heavily laden with quantitative terms; those using a United States History textbook with considerably fewer quantitative terms; and those using both of these textbooks. Their Quantitative Concepts Test scores were analyzed to determine whether their understanding of quantitative concepts was affected by the type of textbook used, or by sex, and whether there was a positive correlation between the understanding of quantitative concepts and reading and between quantitative concepts and math.

FINDINGS: By use of the analysis of covariance to adjust for differences in grade point averages, reading, vocabulary, and math scores, no significant differences were found in the understanding of the quantitative terms among the students using either or both of the United States History textbooks. However, boys were found to understand quantitative terms significantly better than did girls. The results also indicated that there were marked relationships between both math and reading ability and the understanding of quantitative concepts. Another finding was that there is no relationship between what students may think their teachers are teaching about quantitative concepts, and the students' own understanding of these concepts.

CONCLUSIONS: The results of this investigation suggest that as children mature their understanding of quantitative concepts increases. Yet even by the eighth grade, students understand only about two-thirds of those types of concepts encountered in their texts. Once this fact is accepted, teachers must make conscious efforts to devise strategies to teach these
concepts. One such strategy would be to give students the opportunity to engage in activities that will provide them actual experiences with numbers in the social setting. The major implication of this study is that students, girls perhaps more so than boys, have not had sufficient opportunities to apply logical thought to concrete problems involving quantitative terms.

RECOMMENDATIONS FOR FURTHER RESEARCH: These further investigations are recommended: (1) An experimental study involving the teaching of quantitative concepts through manipulative materials versus the lecture-discussion approach. (2) Teaching quantitative concepts in a math class, integrating them into a social studies course, and measuring gain through pre- and post-tests. (3) A longitudinal study following a specific group of students for two or three years to study their growth of understanding of these concepts. (4) A study where teachers are told that pre- and post-tests on quantitative terms would be given in the fall and the spring and the teachers dichotomized in terms of heavy emphasis versus little emphasis on quantitative concepts teaching.
ACKNOWLEDGEMENTS

I wish to thank Professor Juanita Curtis for helping me to set goals and meet tentative deadlines for the completion of this study. Her encouragement and advice were deeply appreciated.

Appreciation must also be expressed to Professor William Theimer for his insight, patience, and understanding of the problems faced during the latter part of the writing of this study. I also wish to express my gratitude to the other members of my dissertation committee: Professors Carolyn Fowle, Douglas Smith, and Lee Fennell for their constructive comments and criticism. A special note of thanks also goes to Professor Robert Hopkins, who helped me through the initial stages of this study.

Further, my thanks goes to the principals, teachers, and children of the Vacaville Unified School District, the Fairfield-Suisun Unified School District, and the Travis Unified School District, who cooperated to make this study possible.

And, finally, a very special appreciation is expressed to my wife, Diane, for her typing of my rough drafts, and other assistance, her patience, and her continuous moral support.
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Chapter 1

INTRODUCTION

In today's highly technological world of films, records, radio, and television, the mass media share much of the responsibility for imparting information. Books, however, remain the major vehicle by which our culture is passed along.1 Junior and senior high school textbooks often contain such stumbling blocks as technical vocabularies, difficult concepts, and long and involved sentences and paragraphs with which the students must cope if they are to comprehend the message of the written page.

In recent years reading materials in social studies programs have been the subject of numerous investigations, dissertations, studies and comments.2 Appraisal ranges from bitter criticisms and wholesale condemnation to high levels of praise and admiration for the improvement noted in the new resources being made available. Each year an array of new textbooks flood the market. In the Fall of 1972, California adopted new social studies texts in grades five through eight for a four year period.3 Yet there still remains a question of whether these new texts


present ideas and concepts any more effectively than have texts in the past.

Bruner⁴ states that certain basic ideas and certain assumptions, if they are initially grasped by the student, facilitate subsequent learning of content. Simple as this point may appear, textbook authors often discard the idea of reinforcing fundamental concepts in the development of new texts.

Concepts presented in modern social studies courses and texts, relate not only to history, geography, and elements of civics, but also include ideas and facts from economics, anthropology, sociology, social psychology, and political science.⁵ In addition to the development of concepts specifically related to these areas, the development of accurate quantitative concepts is also essential. Teachers of social studies should develop an awareness of the degree of students' understanding of certain types of quantitative concepts expressed in social studies textbooks.

Concepts of time, space, and quantities are three of the many social studies concepts which have received research attention. Wilson⁶ analyzed geography, history, and arithmetic texts for quantitative terms used in grades four to seven. He found that definite quantitative terms used in geography generally appear at the corresponding grade in

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arithmetical books. However, Wilson made no attempt to measure the extent to which the students understood these concepts.

Millis\textsuperscript{7} compared reading comprehension and understanding of social studies terms. He reported a low correlation between reading and the understanding of social studies terms.

In a later study, Jensen\textsuperscript{8} investigated the extent to which fourth and sixth graders understood quantitative concepts expressed in social studies textbooks. He found that fourth grade children had serious difficulty understanding the quantitative content presented in their social studies textbooks. Tested on the same concepts from the fourth grade books, sixth grade students understood only 50 percent of the concepts referred to.

In another investigation in grade six, Muscio analyzed quantitative understanding and its relationship to several variables. He found the following factors closely related to quantitative understanding:\textsuperscript{9}

1. Sex
2. Arithmetic achievement
3. Reading achievement
4. Intellectual capacity


\textsuperscript{9}Robert P. Muscio, "Factors Related to Quantitative Understanding in the Sixth Grade," \textit{Arithmetic Teacher}, IX (May, 1962), 258-62.
However, other investigations conducted by Friedman,\textsuperscript{10} Scott,\textsuperscript{11} and by Dobbs\textsuperscript{12} indicated that although reading achievement was a significant factor in understanding quantitative concepts, sex was not a significant factor.

The studies mentioned above and other analyses of the readability of social studies materials have been conducted with particular attention to the nature and frequency of quantitative terms. Investigations have been carried out at the elementary school level with little attention given to either the type of quantitative concepts expressed in eighth grade social studies texts, or of the students' understanding of these concepts.

\textbf{STATEMENT OF THE PROBLEM}

As the studies referred to above indicate, students at the elementary school level have considerable difficulty in understanding quantitative concepts. Now at the junior high school level there is a further need to determine the extent to which eighth grade students understand the quantitative concepts expressed in social studies textbooks. Although new state-adopted social studies texts were introduced in grade eight during the 1972-73 school year, there is no evidence that


eighth grade students understand the quantitative concepts expressed in these new texts.

At the eighth grade level student understanding of quantitative concepts is of particular importance. The studies referred to above have indicated that elementary students are presented with quantitative concepts in their social studies and that their understanding of these concepts is poor. As the students reach the upper grades and as the readability of textbooks becomes more difficult, the students' different interpretations of terms such as "most," "vast," "long before," "large body of water," and other vague, indefinite terms become even more critical. Studies of people, places, and things removed in terms of time and space increase the learner's dependence upon reading as a means of accumulating information and concept building. Social studies teachers must become aware of the extent to which these types of concepts are incorporated in students' textbooks and of the depth of student understanding of these concepts.

RATIONALE

Justification of the Study

In his study of social studies content in the middle grades, Alilunas found that there was little agreement by textbook authors on the content and concepts found in social studies texts. He concluded that middle grade children who use the textbooks designed for grades four, five, and six were exposed to a multitude of historical and

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geographical terms which the average American adult citizen would find strange and confusing. Textbooks examined were lacking in agreement on a good basic glossary of names, events, and places and included far too much vocabulary that was too esoteric for middle grade children and which induced the mere mouthing of words rather than genuine social studies understanding.

Gill's\textsuperscript{14} study offered further evidence of the difficulty students have in interpreting quantitative concepts stated in their texts. The range of responses to indefinite quantitative terms such as many, few, several, a great deal, and millions was very wide and often the median did not approximate a reasonable answer. Gill concluded that for the group tested the range of responses to indefinite quantitative textbook statements indicated that they communicate nebulous and erroneous information to a large percentage of students. Three years later Gill\textsuperscript{15} conducted a similar study with high school students and his findings confirmed those of his earlier study.

In an investigation by Jarolimek and Foster\textsuperscript{16} a determination was made of fifth grade children's comprehension of quantitative concepts in randomly selected social studies textbooks. They found that many quantitative concepts were present in fifth grade textbooks, but that if


children were left unguided in their reading, the teacher could expect them to understand only about half the number of concepts they encounter. In a later study Arnsdorf\(^\text{17}\) concluded that comprehension of concepts by children is relatively shallow indicating that the pupils are acquainted only with the content in question rather than the concepts expressed.

In an earlier study of children ages six through thirteen, Cohen, Dearnley, and Hansel\(^\text{18}\) found that children of the same age vary enormously in their interpretations of indefinite expressions. An analysis of a study by Lyda and Robinson\(^\text{19}\) revealed that second grade children also have great difficulty in understanding quantitative concepts.

The two eighth grade United States History textbooks analyzed in this study differ markedly in their readability level. The first book, *We the People*, has a reading level that ranges from 4.5 to 5.5, as determined by the Dale-Chall formula\(^\text{20}\). The second book, *Quest for Liberty*, has a reading level of approximately 6.8, as also determined by the Dale-Chall formula\(^\text{21}\).

Quantitative terms and concepts are employed by writers of


elementary and junior high school social studies textbooks. Different types of these terms are used, and they are used with great frequency by such writers.\textsuperscript{22} The frequency of occurrence of these concepts indicates a need for concern by teachers with regard to the nature of the concepts presented and the accuracy of student comprehension of these concepts. The findings of this study may help teachers to become aware of the difficulty that students have in understanding quantitative concepts expressed in eighth grade social studies textbooks and of the need to clarify the meaning of these concepts.

**Purpose of the Study**

It was the purpose of this study to answer the following questions:

1. To what extent are quantitative concepts encountered by eighth grade students in United States history textbooks?
2. How well do eighth grade students understand the quantitative concepts expressed in United States history textbooks?
3. Do eighth grade girls understand quantitative concepts better than eighth grade boys?
4. What is the relationship between reading achievement and the understanding of quantitative concepts and what is the relationship between math achievement and the understanding of quantitative concepts?
5. What is the relationship between students' perceptions of the teaching of quantitative concepts and the students'...\textsuperscript{22}Gill, Jarolimek and Foster, Arnsdorf.
understanding of these concepts?

Students from a Northern California area involving three unified school districts were selected on the basis of stratified random sampling. The sample consisted of twelve eighth grade United States history classes chosen from the five schools used in the study. Content analysis was used to determine the nature of quantitative concepts found in the textbooks. Students' reading and math achievement test scores were obtained from school records. A quantitative concepts test based on quantitative expressions common to the two textbooks analyzed in this study was constructed by the investigator and given to the students selected for the study. A pilot test involving the test instrument was conducted in two eighth grade United States history classes from one of the schools used in the study.

HYPOTHESES

This study was based upon the following hypotheses:

$H_1$: After statistically controlling for the variables of vocabulary and comprehension achievement scores, math concept achievement scores and grade point averages, eighth grade students using a U.S. History textbook which has a greater number of quantitative concepts perform better than eighth grade students who are using a U.S. History textbook which has fewer quantitative concepts on a test designed to measure the extent to which students understand quantitative concepts used in their U.S. History textbooks.

$H_2$: After statistically controlling for the variables of vocabulary and comprehension achievement scores, math
achievement scores, and grade point averages, eighth grade students using a textbook with many quantitative terms and a textbook with fewer quantitative terms perform better than eighth grade students who are using only one of the textbooks, on a test designed to measure the extent to which students understand quantitative concepts used in their U.S. History textbooks.

H₃: Eighth grade boys perform as well as eighth grade girls on a test designed to measure the extent to which students understand quantitative concepts used in their U.S. History textbooks.

H₄: There is a positive correlation between reading achievement and the understanding of quantitative concepts.

H₅: There is a positive correlation between mathematical achievement and the understanding of quantitative concepts.

H₆: There is a positive correlation between perceived teacher activity and the understanding of quantitative concepts.

Limitations of the Study

1. This study was limited to the basic social studies textbooks in grade eight that were adopted by the State of California, We the People and Quest for Liberty; it is not concerned with state adopted supplementary textbooks, nor with other textbooks that districts may have purchased from commercial publishers.

2. Further limitations concerned the school districts involved in this study and from which conclusions were drawn. The samples were drawn from three selected school districts in a one county area between San Francisco and Sacramento. The findings and conclusions of this study
may not be applicable to districts unlike those sampled.

3. A third limitation of this study was that it was concerned only with an analysis of quantitative concepts discussed in social studies textbooks.23

Definition of Terms

For the purpose of this study, the following definitions of terms were used.

1. The term social studies is defined as the studies which describe the organization and development of human society and man as a member of social groups. Social studies include such subjects as history, geography, civics, anthropology, sociology, political science, problems of democracy, psychology, psychiatry, and sometimes philosophy and ethics.24

2. Basic social studies textbooks refer to the following titles selected by the State of California in grade eight: Quest for Liberty and We the People.25

3. A "quantitative concept" was defined as "any reference or term that designates or implies an increase or a decrease in amount--any phrase, term, or word concerned with measuring, estimating, or

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23Jensen, p. 48.


4. The content analysis instrument will consist of seven major categories with appropriate indicator examples:

A. Specific references to quantities, such as: 30,000 men, 50 percent of the workers, the third course, $7,500.

B. Indefinite references to quantities, such as: several hundred men, many of the workers, a few reasons, much money.

C. Specific references to space, such as: fourteen inches, four square miles, forty-five acres.

D. Indefinite references to space, such as: hundreds of miles away, one-fourth the size of Texas, most of the land.

E. Specific references to time, such as: five years, fourteen centuries, six days, eight weeks.

F. Indefinite references to time, such as: many years, later, soon, a short time, long hours.

G. Graphic devices, such as: scale of miles, pictorial graphs, bar graphs, line graphs.

5. Teaching quantitative concepts means that a teacher provides a definition of these terms by involving students in learning activities such as weighing, measuring, estimating, comparing, contrasting, and discussions of quantitative terms.

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26 Jarolimek and Foster, p. 437.
SUMMARY

In the first chapter of this study an introduction was presented, pointing out that students have great difficulty in understanding the quantitative concepts expressed in social studies textbooks. The rationale for the study was developed, hypotheses were listed, and limitations of the study and definitions of terms were discussed.

Chapter 2 presents a review of the literature related to the problems of children's understanding of quantitative concepts.
Chapter 2

REVIEW OF THE LITERATURE RELATED TO THE STUDY

INTRODUCTION

Social studies textbooks perform one of the most important functions in the instruction of students.\(^1\) Therefore, writers have been concerned with the extent to which these textbooks foster understanding on the part of the students.\(^2\) This study was primarily concerned with the quantitative content included in selected eighth grade social studies textbooks using the criteria suggested by Sax.\(^3\)

The literature that was considered relevant to this study was reviewed in six major areas. First, social studies textbooks will be discussed in terms of selection and readability. Second, students' understanding of the ideas presented in social studies materials will be analyzed. Third, the development of concepts in children will be examined. Fourth, theories and research pertinent to children's

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understanding of time and space concepts will be reviewed. Fifth, studies relative to children's understanding of quantitative terms and concepts will be examined. Sixth, studies dealing with student evaluation of teachers will be considered.

SOCIAL STUDIES TEXTBOOKS

Instruction in school involves a large amount of textbook reading on the part of the student. Therefore an analysis of the process by which social studies textbooks are evaluated is of major importance. Massialas, for example, questions whether the textbook author speaks to the given age level of the students and whether he uses ill-defined terms and ambiguous words.

Selection of Social Studies Texts

Brodbelt emphasizes the importance of the textbook when he states, "There is no influence in American schools which does more to determine what is taught to pupils than does the textbook." Thus, the textbook is still the mainstay of most classroom teachers. According to Brodbelt, the selection of a textbook involves a carefully determined, well thought-out criteria, based upon a comprehensive philosophy with goals clearly defined to meet the broader objectives of the curriculum. He stresses that whenever possible the ultimate aim in selecting textbooks


is that the textbook match the developmental level of pupils in terms of vocabulary, conceptual development, interest, and cognitive knowledge. Part of Brodbelt's mathematical criteria includes readability and vocabulary development as well as progression of facts to concepts to generalizations. Ideas and concepts, including those concepts dealing with quantitative terms, should be clearly and logically presented.

Brown and Brown agree with Brodbelt when they state that the textbook remains one of the most important basic tools for social studies teachers. One of the key areas of investigation and evaluation, according to Brown and Brown, is the matter of concepts and the clarity with which these are developed. The reader should question the number of new concepts offered per chapter, the number of times they are repeated and reinforced, and the degree to which logical and careful development lead to pupil understanding. The present study is an attempt to analyze two United States History textbooks utilizing these types of questions.

Miller and Berry further underscore the importance of the careful selection of textbooks. All too often, they point out, inadequate consideration is given to the various textbooks available for a course or subject matter, although the effectiveness of the teaching-learning situation depends to a large measure upon the instructional materials employed. Many textbooks, they charge, are not analyzed in the light of


established selection criteria, but are chosen with less investigation than is employed in the selection of a case to house them. Thus, the effectiveness of the presentation of quantitative concepts in social studies textbooks is rarely considered.

In 1966, Willett found that effective criteria for the selection of textual materials in teaching third grade map reading included an examination of content, organization, readability, format, and supplemental aids. As a result of screening according to the criteria referred to above, four sets of map reading materials, each from a different publishing company were taught separately to four third grade classes for a sixteen week period. The control group had fifty-two children, while the experimental group had fifty-six children. On the basis of the pre and post testing of the experimental and control groups which produced no significant differences among the four map reading programs, Willett concluded that the selection process used and the criteria established were effective in selecting appropriate materials. Yet he also stated that teachers preferred one set of materials for average and above average students, and a different set of materials for the below average students. No explanation was given for this teacher preference. In addition, Willett failed to consider in his criteria the nature and extent of quantitative terms used in these materials.9

These studies point out the need for established criteria in the selection of textbooks. Once this criteria has been established, particularly in terms of reading level and clarity and development of

concepts, the selection process becomes considerably more meaningful. Willett's study indicated that different types of materials screened according to a set criteria were all effective in helping students learn.

Readability of Social Studies Materials

The almost universal use of textbooks in teaching the various subject fields means that pupils must comprehend the text material or miss a large part of the information for which they are responsible.10

There is considerable evidence that many students may be unable to read the social studies textbooks which are assigned to them. Studies have shown that many social studies textbooks are simply too difficult for the students. Sloan analyzed the readability of social studies textbooks for grades four, five, and six and found that approximately half of the books were inappropriate for the grade level assigned by the publishers.11 Particularly questionable was the readability of questions, activities, and projects. In addition there was little continuity found between textbooks in a given series of one publishing company.

In a similar study, Arnsdorf analyzed several elementary school basal social studies textbooks to determine levels of readability within and between the books of a series.12 Twenty-five textbooks from four basic social studies series were examined. Two reading formulae were

10 Samuel Weintraub, "Research: Textbooks," Reading Teacher, XXI (December, 1967), 283.
used, the Spache Readability Formula for Primary Grade Materials and the Dale-Chall Formula for Predicting Readability for intermediate grades. Each formula is based upon two counts—the percentage of unfamiliar words and the average sentence length. The formulee differ in the relative weights assigned to sentence length and "hard-word" scores. Each text was divided into thirds and then analyzed by randomly selecting samples from each third until 100 samples were drawn, or in the case of the first and second grade books, the entire book was used. Arnsdorf found a wide range of readability within any one reader, the easier and harder reading occurring anywhere throughout the book. The readability of nearly half of the readers he examined was suited for a higher grade placement and three of the twenty-five books did not follow the publisher's suggested sequence according to the readability estimates based upon the entire text.

In another study again using a readability formula Janz and Smith examined the comprehension that upper grade students have of their social studies texts, dealing with Georgia history and geography. Of the three textbooks assigned to 200 eighth grade students in social studies classes, all of the texts were too difficult for better than 60 percent of the students according to the Flesch Readability formula. The readability range of these texts was from grade nine to college. At the ninth grade level, five social studies texts were analyzed and found to be too difficult for 75 percent of the students.

These findings have been substantiated by the study by Mills and

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Richardson who sent a questionnaire to twelve major publishers of basal readers asking questions about the readability formulas used by the companies in grading their readers.\textsuperscript{14} Only about half of the publishers responded, and half of these said they used no readability formulas but relied on the judgment of authors or educational consultants to determine the grade level of the basal readers. Using readability formulas, the investigators evaluated 200 basal readers and concluded that one-half of the books did not correspond with the intended grade.

Some studies of the readability of social studies textbooks involved teacher judgment rather than the use of readability formulas, but the results were similar to the findings reported above. For example, Mingle's study used teachers as judges to appraise the appropriateness of reading materials for the third grade social studies program in Dade County, Florida.\textsuperscript{15} Of eighty-four books examined, only one-third were rated appropriate for their level of difficulty.

Smith and Dechant have summarized a number of textbook readability findings.\textsuperscript{16} The consensus of their studies is that the texts in any particular content area may run one or more grade levels above their placement. The comparative difficulty of content area texts varies with the study, but texts in mathematics, science, and history were generally noted for their problems in readability. In addition, other studies

\textsuperscript{14} Robert E. Mills and Jean R. Richardson, "What do Publishers Mean by Grade Level?" \textit{Reading Teacher}, XVI (March, 1963), 359-62.


have substantiated the findings of Smith and Dechant. ¹⁷

Much of the problem involved with the difficulty of reading social studies textbooks is the vocabulary load that is presented to students. Haffner analyzed selected publisher-designated fifth and sixth grade social studies, history, and geography textbooks in order to determine and compare the reading level, the vocabulary load, and social-concept burden of the textbooks. ¹⁸ Forty-two textbooks were submitted for evaluation by different publishers and the author concluded the following: sixth grade textbooks presented less vocabulary difficulty than fifth grade textbooks; both fifth and sixth grade textbooks contain excessive vocabulary loads and concepts; and the social-concept burden is greater in sixth grade textbooks than in fifth grade textbooks.

In another study, Lidberg collected and analyzed responses to reading selections from three commonly used social studies textbooks in grades four, five, and six. ¹⁹ The reading selections were used to determine comprehension, erroneous concepts arising from lack of comprehension of reading materials, and the familiarity of uncommon words. Eighteen reading selections were randomly chosen from nine textbooks on the three grade levels. The students were given multiple choice tests


and their test scores were correlated with the grade equivalent scores of the reading, work-study and composite results of the Iowa Test of Basic Skills. Lidberg concluded that the vocabulary load within the texts was generally heavy, and this seemed to be because of the number of difficult words rather than because of the special terms involved in the content; another conclusion drawn was that words having more than one meaning had fewer correct interpretations when a less frequently encountered interpretation was used. He further concluded that time and space relationships were not well developed or understood by elementary students.

Lidberg has shown that even when vocabulary is familiar to students, words with multiple meanings often are misunderstood by students. As Smith has pointed out, two different handicaps confront pupils who are faced with huge vocabulary loads such as are found in social studies materials. First, pupils are often found with vocabulary that is unknown to them. Secondly, they are often confronted with vocabulary that contains familiar words that become incomprehensible in an unfamiliar setting. Russell and Saadek clarified this latter difficulty by their study of qualitative levels in children's vocabularies. They asked third, sixth, and ninth grade pupils to define a number of words and proceeded to classify their responses into one of three categories; concrete, functional, or abstract. For instance, they used the word

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"count." If the pupils' response was similar to "find how many pennies are in your pocket," it was labeled concrete; "the number of things in a group" was classified functional; and abstract responses included "to say numbers in order-upward or downward." That concreteness and abstractions increased in the lower and higher grade levels, respectively, indicates that the same words have different meanings to different people.

In another study Howards hypothesized that significant differences exist in elementary school children's understanding of the various meanings of selected multiple-meaning words. He devised a multiple-meaning word list consisting of forty monosyllabic multiple meaning words derived from Webster's New Collegiate Dictionary (1959). A total of 526 fourth, fifth, and sixth graders were tested and although the differences between the fourth and fifth graders were greater than those between the fifth and sixth graders, all the differences were statistically significant at the .01 level of confidence. Howard concluded that frequency of occurrence does not guarantee familiarity for a reader.

McKee also emphasized the difficulty in the understanding of multiple-meaning words for children of different ages:

Obviously in measuring the vocabulary difficulty of a book, one needs to measure the degree of difficulty which pupils have in understanding the meanings of words in the settings in which the words are used. Such measurement requires the use of a test of word meanings in which pupils understand at a given age or grade levels, rather than a list of word forms used most frequently in reading matter.

These studies have shown that children have considerable

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difficulty in reading their social studies textbooks. Many textbooks are written at a higher grade than is appropriate for the students for whom they are written, and often publishers fail to use any type of readability formula when considering the publication of these textbooks. Generally the vocabulary load is an excessive one and students are not prepared to cope with familiar words which become confusing in an unfamiliar setting.

After reviewing the research on the adequacy of the textbook as a source and mode of teaching, Hill concluded that the American content area textbook presents a formidable reading learning task even when the student has some mastery of reading and study procedures. Hill further states that the content area textbook, as traditionally used, is less help and possibly more of a hindrance to the student. He concludes that the textbook, "... lengthy, densely filled with concepts, is too difficult in general vocabulary, and is written in a generally impersonalized manner."

UNDERSTANDING SOCIAL STUDIES MATERIALS

It is common knowledge among experts in elementary education that too many children fail to gain an adequate understanding of the numerous concepts contained in content subject textbooks simply by reading the textbook in question. Many of the concepts are expressed in abstract terms or in vocabulary words unfamiliar to the student.

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The Treatment of Social Studies Concepts

Johnson studied the understanding of the vocabulary in six fifth grade subject areas, including science, history, and geography. She found that many of the vocabulary terms expressed concepts with which students had had little previous experience.

Many of the social studies concepts that have been included in students' textbooks have been treated inadequately, even when the vocabulary was not noted as a major problem. Dimitroff examined thirty social studies textbooks used in the intermediate grades on the basis of fifteen social studies generalizations judged important by scholars. She concluded that the treatment of the fifteen generalizations was uneven and inadequate in twenty-seven of the textbooks studied. A few years later, Johnson analyzed the content of the five leading American history textbooks for grades five and eight in terms of eighty-nine social science concepts identified as important to the understanding of the social science disciplines. The appearance of each term was coded according to the extent of treatment given it. Of 42,458 usages of the terms in the ten books, only 1,000 usages were at the level of definition, illustration, or explanation. Two-thirds of the terms were omitted or

26 Mary E. Johnson, "The Vocabulary Difficulty of Content Subjects in Grade Five," Elementary English, XXIX (May, 1952), 277-80.


virtually ignored in the fifth grade textbooks. Johnson concluded that the ideas social scientists hold as important were not treated adequately in the ten American History textbooks.

Israel did a similar study in which the social studies textbooks for grades four, five, and six used in Mississippi schools were analyzed to determine the extent to which selected social studies concepts were included.\textsuperscript{29} The number of pages relevant to the concepts were tabulated and totals were then computed for the amount of content relevant to each concept in each individual textbook. It was found that with the exception of geography, the development of the concepts from the disciplines was judged to be inadequate.

Although these studies indicated that social studies concepts are poorly developed in textbooks, the studies would have been more meaningful if the authors had addressed themselves more to the question of how concepts were adequately developed in some of the textbooks examined. In Dimitroff's study, for example, three of the textbooks apparently covered the fifteen social studies generalizations evenly and adequately. Yet nowhere does the author stress what factors made the concepts in these three textbooks more comprehensible to students.

\textbf{Comprehension of Social Studies Concepts}

Even when proper concepts are included in the textbooks, students often have a poor understanding of the concepts. Leavell and Hollister asked some junior high school pupils to list the unfamiliar words met in

their social studies material. These students listed about 30 percent of the words as being unknown to them. An earlier study had found similar results. Due to the use of figurative language and abstract words and concepts, pupils with normal seventh grade reading ability could answer only 31 percent of the questions which were based on fifth grade history textbooks used throughout the county.

Serra reviewed studies on the concept burden to be found in various elementary level textbooks. The studies contained in her review suggested that social studies materials carried an excessive concept load. Serra found that reading in social studies was further complicated by the fact that the concepts were not sufficiently developed for pupils to understand them.

Other authors have questioned the depth of the concepts children possess. Mugge questions whether children actually know social studies concepts, or whether they use these concepts with only a limited understanding.

De Silva investigated the process by which adolescent students ascribe meanings to coded words standing in for historical terms, using

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33Dorothy J. Mugge, "Precoecity of Today's Young Children: Real or Wishful?" Social Education, XXVII (December, 1963), 436-39.
contextual cues alone. His study supported the assertion that much of school history is taught through contextual passages without a precise definition being given. This, he concludes, makes for erroneous concepts.

Dallolio also decries the lack of definition of social studies terms:

In social studies there are a large number of unique words that denote special concepts, and which must be developed and learned if children are to advance in the area. Especially difficult are the abstract words. Students may be able to pronounce unique, difficult or abstract words but to arrive at their meaning would be extremely unlikely. . . .

Too frequently authors introduce specialized words with inadequate or no attempt at defining them. Moreover, they inject new ideas without providing a sufficient context of meanings to clarify them.

Earlier, Dolch found that students were so overwhelmed with the number of facts on a page that they were totally confused. In sample counts taken from five sixth grade geography textbooks, 24.3 to 48.0 facts per page appeared.

Peel asserted that children make of the textbook information what they can by virtue of their particular level of development. The meaning they ascribe to particular words or to a particular concept may not be what was intended.

Watts ascribes as part of the difficulty students have in


understanding social studies terms the number of concepts students encounter. The concepts, she asserts, seem to increase geometrically, while ways to clarify these concepts increase only arithmetically. She concluded that certain presentation modes used with pupils as a means of conceptual clarification correlated positively with gains made on a geographic terms achievement test.

Thus, the studies by Leavell and Hollister and by Faison have indicated that students are presented in their social studies materials with many terms and concepts that are unfamiliar to them. A second problem with student comprehension is the lack of definitions and the poor development of concepts as pointed out by De Silva, Dallolio, and Serra. In addition, Dolch and Watts have stressed the tremendous number of facts and concepts that students encounter in their social studies materials, most of which the publishers fail to clarify. Furthermore, other authors such as Mugge and Peel have questioned the depth of student understanding of many of these concepts.

CONCEPT FORMATION

The new social studies seems to be characterized by the concern

39 Leavell and Hollister, pp. 287-93.
40 Faison, pp. 43-51.
41 De Silva, pp. 174-82.
42 Dallolio, pp. 144-49.
43 Serra, pp. 103-108.
44 Dolch, pp. 135-38.
46 Mugge, pp. 436-38.
47 Peel, pp. 169-80.
for the development of conceptual understanding. Yet with the abundance of research dealing with the learning process, there has been relatively speaking, little compiled in the area of concept formation in social studies. Sax has noted that:

From the period 1960 to the present, there has been an almost complete lack of research interest in concept information in areas other than mathematics and science. Generally, the unpublished material on concept formation in the social studies has tended to be vague or weak in experimental design or has included suggestions for innovations without evidence to support them.

Martorella has also pleaded for more research on the need for concept development including types and hierarchy of concepts.

A study by Dodge supported the value of utilizing a concept approach in the teaching of American history. In this study, an eight week experiment was designed and an investigation conducted in which a concept-generalization approach was taught by one teacher to two eighth grade classes which contained a total of sixty-four pupils. This teacher selected key ideas and developed these ideas in the unit. The traditional approach was taught by another teacher to two eighth grade classes which contained a total of fifty-nine students. The traditional teacher emphasized facts and adhered strictly to the texts. Both groups of


students used the same texts and covered the same units. Dodge found that although there was no significant difference between the groups in the amount of facts learned, the concept-generalization classes were superior in learning and organizing historical knowledge. Dodge concluded that concept development tends to make the pupil's learning an active, unifying process, and that pupils need guidance and practice in developing conceptual skills on a step by step basis. It appears that this study would have been strengthened considerably had Dodge used both teachers to teach both approaches so that the "teaching style" variable had been removed. There is also considerable doubt that a sample of fifty-nine students is sufficient to warrant any types of generalizations.

Concepts Defined

Although writers agree on the importance of developing concepts, there is little agreement on how concept is defined.

Quillen and Hanna, for example, state that:

A concept is a general idea, usually expressed by a word, which represents a class or group of things or action having certain characteristics in common.\(^5^2\)

Martorella defines a concept somewhat differently:

A concept is a continuum of inferences by which a set of observed characteristics of an object or event suggests a class identity, and then additional inferences about other unobserved characteristics of the object or event.\(^5^3\)

Other definitions of concepts include:


\(^{5^3}\)Martorella, p. 890.
... a classification or systematic organization of stimuli or events which have common characteristics. 54

... cognitive organizing systems which strive to bring pertinent features of past experiences to bear upon a present object. 55

... properties of organismic experience--more particularly they are abstracted and often cognitively structural, classes of "mental" experience learned by organisms in the course of their like histories. 56

... a class or group, or one aspect of a class or groups, usually with a label attached to it rather than an individual instance. 57

Platt has acknowledged the difficulty of defining the term "concepts" and suggests that many people merely substitute other words or labels, such as an idea, abstraction, principle, generalization, value, or theme. 58 He defines concept as "something about an idea expressed in the words of our language," and he suggests that a concept should be stated as simply and directly as possible avoiding compound sentences, which he sees as generalizations.

Venacke states that a concept has a number of definite characteristics. 59 First, it has a point of reference with respect to

59Venacke, pp. 527-29.
all other concepts. Second, concepts are accurate or consistent. Third, concepts always combine the objective properties of the object and the subjective interpretations of the individual.

Bruner divides concepts into three distinct classes, conjunctive, disjunctive, and relational. Conjunctive refers to a classification consisting of common elements. Disjunctive concepts have alternate attributes, which may vary from time to time. Relational concepts refer to the relationship among the attributes of a concept.

Piaget and Cognitive Development

Although not concerned with the definition of a concept as such, Piaget has written extensively on the cognitive development of the child and the factors affecting the child's acquisition of information.

Intellectual functioning, according to Piaget, is characterized by the process of "assimilation" and "accommodation." The interplay of these two processes is known as "adaptation." When an organism uses something in its environment for some activity which is in accord with the organism's intellectual organization, the act is one of assimilation. In the process of ingesting foodstuffs to itself, the organism is involved in the process of assimilation. If an organism acts in a


particular manner because a situation resembles a similar situation in the past, assimilation is also at work. Accommodation, on the other hand, means that the organism has added new activities or modified old patterns to meet the demands of new occurrences. Berlyne has summed up the difference between assimilation and accommodation as follows:

At all events, assimilation seems to include what learning theorists call "generalization" and "discrimination," processes determining which response a particular stimulus will elicit while accommodation covers "differentiation of responses." Berlyne further points out that as the child matures and develops, he achieves a balance between assimilation and accommodation: "The child is able to take account of stimuli more and more remote from him in space and time, and to resort to more and more composite and indirect methods of solving problems." However, Piaget points out that concept formation in children is closely tied to certain stages of growth, or chronological age levels. These stages of intellectual development, according to Piaget are:

1. Sensori-motor intelligence--from birth to two years. During this period behavior is primarily motor. The child does not "think" conceptually, though "cognitive" development is seen.

2. Preoperational Thought--from two to seven years. This period is characterized by the development of language and rapid

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64Ibid.

conceptual development.

3. **Concrete operations**—from seven to eleven years. During these years the child develops the ability to apply logical thought to concrete problems.

4. **Formal operations**—from eleven to fifteen years. The child's cognitive structures reach their greatest level of development, and the child becomes able to apply logic to all classes of problems.66

Piaget summarizes his theory of intellectual development as follows:

The development of intellectual capacity is constant in its order but not in the duration of each stage of development. Factors which contribute to this pattern of development are: maturation of the nervous system, experience, social transmission, equilibration or autoregulation. The first three factors have in common that the individual is passive. Something is done to him—his physiological system matures, or he is presented with physical or linguistic material to absorb. The individual, however, finds it necessary to call upon the factor of his own activity and his role is not so passive. An individual comes to see his world as coherent, as structured, to the extent that he acts upon the world, transforms it, and succeeds in coordinating these actions and transformations. Development (intellectual) proceeds as partial understandings are revised, broadened, and related to one another.67

**Concept Attainment**

The derivation of meaning from experiences is the crux of the process of developing concepts, according to Reynolds.68 Using Piaget's


schemata, Reynolds stresses that as children are confronted with various problems and concerns, they are made aware of relationships between the thoughts emerging from new situations and the ideas and opinions they already hold. When children assimilate new data and accommodate new data, the result is an affirmation or extension of meaning. Reynolds emphasizes that the building of concepts is a gradual process of provided experiences bringing together new thoughts and relating them to thoughts previously held and naming the thoughts with a term that denotes a common characteristic.

Rogers also is in agreement with Piaget when he stresses that students must have concrete experiences before abstractions are possible. The importance of concrete experiences was further underscored by Spodek's study of teaching social science concepts to kindergarten pupils. He taught nineteen kindergarten children a unit on New York as a harbor. Significant concepts were broken down into specific understandings that, it was felt, kindergarten children could attain. At the end of ten weeks, each child was interviewed in order to collect evidence on the children's attainment of the desired concepts. Spodek concluded that the ability of kindergarten children to attain the significant concepts was not determined by the phenomenon studied, but rather by the abstractions or concreteness of the phenomena.

The "here and now" concept of social studies did not seem to hold true for these children. It seemed more important that the children were able to deal with concrete objects, real or

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representational, which enabled them to gain meaning from the experiences.71

Arnoff was also in agreement with Piaget when he asserted that children not only enter the classroom with a rich background of experiences and information, but that they use this base to achieve more complex concepts and generalizations.72 Thomas goes a step further when he states that no one can give the learner his concepts, but that the learner must construct them out of his own experiences.73 Asbury also emphasizes that effective teaching of concepts means that the teacher takes into account the experiences of the student in relation to the concept.74

Frederick studied the effect of a vocabulary readiness program on ninth grade students and found that vocabulary development was not related to concept learning.75 In surveying a number of studies pertaining to the effectiveness of verbal versus pictorial presentation as the best method of concept attainment, Lewis concluded that the current evidence points to the superiority of student verbalization.76

Venacke's research seems to bear out the findings of Frederick and Lewis. He found that scores on various kinds of concept tests

71Ibid., p. 255. 72Arnoff, p. 548.
correlate only moderately with intelligence. In addition, he found that scores on concept tests also have a low correlation with vocabulary.77

Venacke has also urged that concept attainment can be fostered in the classroom if the child is exposed to the ingredients of concepts—that is the concrete properties of objects and their relations to each other. It is from these materials that the child evolves precise, stable, and complete conceptions. Venacke also stresses the need for the child to have guidance in learning how to generalize, to symbolize, and to apply the same concept to a variety of situations.78

Fawcett and others go into even more detail.79 Teaching concepts involves: consideration of the necessary factual background, the relationship of the concept to other concepts, the intellectual skills and abilities necessary to understand the concept, the time the concept should be introduced, the sophistication level it should be taken to, and the type of reinforcement that will be needed.

Some general principles of concept attainment were listed by Venacke as a result of his studies:

1. Increasing age is the single most important variable in concept formation. The changes which occur with age are more rapid in the early school years than in later years.

2. Progress in learning concepts is a continuous and cumulative affair rather than occurring in distinct phases.

77 Venacke, p. 528. 78 Ibid., p. 531.

3. Earlier concept learning provides a preparation for later development.

4. Other important specific changes which take place along with age are:
   A. Progression from the simple to the complex
   B. Progression from diffuse to differentiated concepts
   C. Progression from egocentric to more objective concepts
   D. Progression from concrete to abstract concepts
   E. Progression from variable to more stable concepts
   F. Progression from inconsistent to more consistent and accurate concepts.

TIME AND SPACE CONCEPTS

Many research studies have been concerned with the point of maturation at which children learn the conventional divisions of time and a vocabulary associated with time. Investigators agree that mastery of the different divisions of time and the relationship of one to the other is achieved as the result of a very complex process that appears to be closely related to maturation. They also agree that children have little or no sense of chronology before they are in the sixth grade and that instruction in such concepts should be delayed until children have matured sufficiently to profit from it.80

Pevix also asserts that many questions about the development of children's concepts of time and space remain unanswered, and that the conclusions mentioned above are being questioned by some investigators.

Early Studies

One of the earliest studies dealing with time sense in children was done by Oakden and Sturt in 1922.81 They hypothesized that knowledge of conventional time as possessed by adults is the result of a gradual process of learning rather than an innate faculty or concept suddenly acquired in infancy or childhood. Various tests constructed by the investigators dealing with time were given to groups of children ranging in ages from four to thirteen. The first test was a "questions" test given to 110 children ranging in age from four to ten. Some of the questions asked were:

1. What is your age?
5. How long would it take you to walk around this room?
14. Robin Hood lived in 1187. (a) Would your mother be alive then? (b) Would your grandmother?
15. Would Christ be alive then?
16. How long is it since the Easter holidays?

The investigators found that older children answered more questions correctly than did younger children, and that duration questions, such as number five were clearly the hardest. Even adults had trouble with question five, which was answered correctly by only one adult out of seven tested. Next in degree of difficulty were questions involving the time and day. Not until they were about seven or eight years old could most children answer questions relating to the day of the year.

On an "order of dates" test, 297 children ranging in age from eight to thirteen, were shown three statements written on the blackboard stating when a famous person lived. For example, one statement was, "Attila lived in Hungary in 438 A.C." The children were told to write down the names of the people in the order in which they lived "beginning with the one who lived longest ago--furthest back in history." Only 51 percent of the eight year olds answered correctly, 67 percent of the ten year olds answered correctly, 85 percent of the twelve year olds answered correctly and 96 percent of the thirteen year olds answered correctly.

In follow-up discussions with the children, it was found that many children did not know whether a bigger number came first (e.g., 1898 vs. 1901), or whether one number was "bigger" than another. Some children seemed to judge the value of a date by its last digit. Most of the children, it was found, were uncertain as to the point from which years are enumerated and were equally uncertain as to whether "B.C." referred to a point in the future or the past.

The investigators concluded that only from about the time they are nine can we assume that most children possess a knowledge of the conventional scheme of time--marking used in everyday life and in history.

Even at that age it is quite unsafe to assume that much more than a half of the class understands the principle on which the chronology is based, or what is intended to be conveyed when the date of some historical characters is given. 82

In a temporal absurdities test given to 358 children ranging in age from eight to fourteen, the investigators found that the distinction between the past and the present was easiest, followed by time as

82 Ibid., p. 318.
measured by reference to natural phenomena or personal activity. The most difficult items were those exemplifying purely conventional marks of time such as 58 B.C. and 30th of March. The authors concluded that there is actually a definite order in which these elements of knowledge are acquired and that the earliest distinction a child makes is between the present and a historical past which is as different as possible from that present.

Other conclusions generalized by this study were:

1. The growth of time concepts is a slow process beginning at about the age of four and arriving at nearly adult level at about thirteen or fourteen years. The most rapid improvement seems to be about age eleven.

2. Marks of time are closely connected with activities or concrete experiences.

3. The understanding of chronology and the arrangement of historical epochs is difficult.

4. Little ability to conceive of continuity and development is apparent up to eleven years of age.

In 1937, Wesley's study pointed out the frequency with which the vocabulary of time concepts is used. Within the first 500 of Thorndike's word list of most frequently used words, twelve words denoted specific time concepts, such as "morning," "year," and "week" and thirty-six words denoted indefinite time concepts such as "long," "never," "soon," and "sometime." Wesley's conclusions also substantiated those

of Oakden when he asserted that although the child of three has little understanding of time, concepts of time develop approximately in proportion to chronological age, so that between the ages of six and twelve the child learns in order forenoon, afternoon, names of the week days, the month, the year, and the day of the month. 84

Wesley also indicates that the psychological basis of time is developed in the individual by a combination of one or more processes, which he labels as the spacial basis, the mathematical basis, and the associative basis. The spacial basis means that the individual has built up a series of concepts that indicate relative locations. For example, "In one hour, I will have walked home from downtown." The mathematical basis refers to a person's mental imagery for remembering days of the week or dates in history. The associative basis of time is based upon specific or sometimes isolated events, but which may have no chronological significance. For instance, all the pupil may know about the date 1066 is that there was an important battle, but he may not know when that date really was. Wesley points out that people who think of dates in this manner learn them with great difficulty. 85

Wesley also constructed a test of time concepts which was given to thirty-one high school students and thirty-one college and graduate students. The students were asked to specify dates for phrases such as "a long time ago," "in ancient times," "in pioneer days," "centuries ago," and "within the very near future." Wesley concluded that the college group demonstrated a superior grasp of chronology, that nearly half of all taking the test did not know the meaning of decade, that many students

84 Ibid., p. 405. 85 Ibid., p. 408.
attach no consistent or even approximate definite meanings to the phrases, and that time phrases of a general nature are interpreted very loosely.86

The results of Pistor's research agree with those of the previously cited studies. First, Pistor designed and validated four tests to measure time concepts: The Time-Analogies Test, and the Time-Causal Test.87 Later, two groups of sixth grade students, with over 300 in each group were tested with his battery of tests.88 The groups were equated on the basis of general intelligence, reading ability, and school achievement. The Mental Age of the children ranged from ten to about thirteen years, and Pistor concluded that training in history and chronology in grades four, five, and six had no effect on the children's concepts of time. Although he denied that maturation was the sole factor involved in the learning of time concepts, he felt it was the most important factor. Unfortunately, there was no discussion of the importance of time concepts related to students' math ability.

The results of Friedman's study supported the conclusions of Pistor, Wesley, and Oakden.89 Friedman's study involved 697 students, kindergarten through sixth grade, in three elementary schools. There were 100 pupils per grade. A Primary Test consisting of seventeen questions which were asked in personal interviews was given to the children in

86 Ibid., p. 410.
grades kindergarten through three. The results were that in kindergarten all students knew the difference between night and day, and morning and afternoon. Eighty-five percent could tell their ages, and most kindergarteners knew whether a minute or an hour was longer. However, no kindergartener could tell what year it was. Half of the children in kindergarten could not tell the difference between something that happened "a long time ago" and something that happened "a short time ago." On the other hand, all third graders knew what year it was and which of the three national holidays was the most recent one. Most children in the third grade could name the days of the week in perfect order. As a result of a similar test given to upper grade children, Friedman found that by grade six most students could answer the day of the week, the name of the month, the time of the day, and the months in perfect order. No differences were found based on sex, but there was higher correlation between grade level and correct answers, than between age and correct answers.

On the indefinite time concepts test given to the children in grades four through six, Friedman found that generally these children understood time concepts better than did the primary children, although the idea of "tomorrow" was less definite for many children than the concept of "yesterday."

In a time words and dates test, students were given seventeen words such as present, recent, century, B.C., and four dates to be translated into centuries. Ninety percent of the fourth and fifth graders were unable to answer many of these items. By grade six, only four of the seventeen words and none of the dates were known by 90 percent or more of the pupils. The most difficult items were the dates and the word "generation." The percentages of correct responses were:
In another test, putting events in correct chronological sequence, the percentages of correct responses were:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percent correct</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>41</td>
</tr>
<tr>
<td>5</td>
<td>53</td>
</tr>
<tr>
<td>6</td>
<td>66</td>
</tr>
</tbody>
</table>

The last test was one in which the students were required to locate along a time line points at which seven stated events occurred. The results were as follows:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Number of pupils making perfect scores</th>
<th>Grade</th>
<th>Number of events correctly indicated</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>12</td>
<td>4</td>
<td>2.85</td>
</tr>
<tr>
<td>5</td>
<td>19</td>
<td>5</td>
<td>3.39</td>
</tr>
<tr>
<td>6</td>
<td>27</td>
<td>6</td>
<td>4.65</td>
</tr>
</tbody>
</table>

In all of these tests Friedman reported no statistically significant differences according to sex and low correlations between I.Q. and test scores, and also between socioeconomic status of parents and test scores:

<table>
<thead>
<tr>
<th>Test</th>
<th>Pearson r correlation coefficient I.Q. and test scores</th>
<th>Socioeconomic status and test scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>Words and dates</td>
<td>.44</td>
<td>.17</td>
</tr>
<tr>
<td>Chronological sequence</td>
<td>.38</td>
<td>.24</td>
</tr>
<tr>
<td>Time line</td>
<td>.21</td>
<td>.02</td>
</tr>
</tbody>
</table>

The low correlation between I.Q. and test scores supports the findings of Venacke, who found that scores on various kinds of concept tests correlate only moderately with intelligence.  

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90 Venacke, p. 530.
Friedman concluded that the growth of time concepts occurs along with increasing maturity, that most children have a satisfactory comprehension of our conventional time system by the time they reach grade six and that children better understand the near in time and space than they do the remote. Further conclusions were that even by grade six, students lack sufficient comprehension to place familiar events in chronological sequence, and that time lines were understood by only a small percentage of pupils.91

These early studies involved students in grades kindergarten through six, students in high school, and students in college. As a result there has been a gap in our knowledge relating to the acquisition of time and space concepts by junior high school students. What these studies seem to suggest however, is that maturation, as Pistor points out, may be the most important factor in the ability of students to grasp these concepts.92 Both the studies by Friedman, and Oakden and Sturt have shown that as children progress through the elementary grades, their understanding of time and space concepts increases.93

Yet although both of these latter studies conclude that by the time children reach grade six, they have a satisfactory or almost adult comprehension of our conventional time system, their findings indicate that even at grade six many students have considerable difficulty in understanding concepts such as decade or indefinite time concepts.94

91Friedman, p. 324. 92Pistor, pp. 293-300.
94Wesley, pp. 403-17.
Friedman's study is also significant in two other aspects: there were no differences found in students understanding of time and space concepts, based on sex; and although there is a higher correlation between grade level and understanding than between age and understanding, there is a very low correlation between I.Q. and understanding of these concepts. Unfortunately, Friedman did not report the grade level and age correlations.

Piaget's Theories of Time and Space

The first point Piaget makes about time, movement, and velocity constructs is that because they are constructs they require a slow and gradual ontogenetic construction.\(^{95}\) Piaget believes that the concept of time is constructed little by little and therefore involves the construction of a system of relations.\(^{96}\) The young child

... initially confuses successions of events in time and the temporal intervals these successions engender with their analogies in space, that is, with the succession of points traversed in a movement and the spacial distances between the points.\(^{97}\)

As the child grows, he develops the capacity to retain events in memory and this capacity steadily increases and includes more and more remote happenings.\(^{98}\) As he matures the basic concepts of time, movement, and velocity develop more or less contemporaneously. The specific abilities that develop include first of all a conceptual grasp of temporal order

\(^{95}\) Flavell, p. 316.


\(^{97}\) Flavell, pp. 316-17.

\(^{98}\) Pulaski, p. 167.
of succession and of the temporal intervals between succeeding temporal points. Then the child learns that many events can happen simultaneously, that time can be measured through temporal units, and that time is related to age. 99

According to Piaget, children do not understand the relationship between time and speed until they are about ten or eleven years old. 100 Prior to this age a child can watch two objects moving from point A to B, one in a direct route and one in a circular route. If they both start at the same time and arrive at point B at the same time, the preoperational child sees both objects as having traveled at the same speed. It is not until after he is eight years old, that the child begins to develop a ratio concept of speed in terms of the relationship between time and distance traveled. 101 Piaget explains that the reason for this deficiency is that before they are seven or eight, children are not capable of reasoning about several possibilities at the same time. 102 From eight to ten years old, the child is capable of constructing a time scale embracing all moments and all events. Piaget also states that while children at Stage I (zero-two years) show a complete lack of differentiation between age and size, it is not until Stage III (seven-eleven years) that children completely disassociates age from size and height. 103 Older children (ages ten-thirteen), he adds, evaluate the time of an

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99 Flavell, p. 318.  
100 Wadsworth, p. 99.  
101 Ibid., p. 100.  
103 Ibid., p. 215.
action by relying almost exclusively on the impressions they obtain during
the action itself and no longer on its tangible results. Because these
older children are able to rely more on their sense of inner duration,
their estimates are very much more accurate than those of younger
subjects.\textsuperscript{104} Piaget explains that time intervals must be related to
speeds. If these intervals, however, were based simply on what has
happened during a given time, the intervals will have a spacial relation­
ship between the space that has been covered, that is what has happened
during that time, and the speed with which it was done.\textsuperscript{105}

In his discussion of the child's understanding of space, Piaget
stresses that our perception of space as it exists is the end product of
long and arduous developmental construction which itself is more dependent
upon actions than upon perception \textit{per se}.\textsuperscript{106} He emphasizes that the child
goes through a process of establishing a picture of space as a kind of
all-enveloping container made up of a network of sites or subspaces.
Holloway has summarized Piaget's theories of the child's development of
concepts dealing with space.\textsuperscript{107} From about two and one-half to four
years of age, the child develops the ability to recognize shapes for want
of sufficient exploration. The child of three and one-half has a

\begin{flushright}
\textsuperscript{104}Ibid., p. 239.
\textsuperscript{105}Jean Piaget, "Relations Between the Notions of Time and Speed
Cognitive Studies and Curriculum Development, eds. Richard E. Ripple and
Verne N. Rockcastle (Cornell University: School of Education, 1964),
\textsuperscript{106}Flavel, p. 328.
\textsuperscript{107}G. E. T. Holloway, An Introduction to the Child's Conception of
Space (Further Aspects of Piaget's Work) (London: Routledge and Kegan
\end{flushright}
representation of space that neglects euclidean relationships (proportions and distances) and projective relationships (perspectives with projections and sections). By the time he is eight or nine years old, the child has reached the visual realm stage and takes into account proportion, perspective, and distance.

Holloway describes one of Piaget's experiments where children were given a drawing of a square and asked to draw the smallest and largest possible squares on the same sheet. They were further asked to subdivide some figures such as a square, a circle, a triangle, or a straight line, and to carry out the subdivision as far as possible. Then the children were questioned in terms of whether the final product resulting from the subdivision was thought of as a point or whether it had a shape. Finally, the children were asked to recreate the original line or figure from its ultimate elements, that is, whether a line or surface can be conceived as a collection of points. Piaget found that it was not until the child was eleven or twelve that his thought was liberated enough from the limitations of the actual drawing so that he could perform all the tasks and answer all the questions successfully. That is, the child had developed the idea of continuity and other topological concepts including proximity, separation, order, and enclosure.

From these and other experiments, Piaget further concluded that until the child is nine or ten, he cannot gauge distances correctly even when he tries to do so; neither can he coordinate reduction or increase of size with distance.108 Moreover, until the child is eleven or twelve, he has not developed true conventional reference systems in space.

108 Holloway, p. 57.
Finally, Holloway summarizes Piaget's conclusions:

Findings show it would be a complete mistake to imagine that human beings have some innate knowledge of global space organized in a two or three dimensional system of rectangular co-ordinates. At the outset a child has not even an awareness of physical or physiological notions of horizontal and vertical, for perception covers only a very limited field, whereas a system of references presumes operational coordination of all fields with one another. This system links together objects considered as such, in their objective positions and displacements as well as their metrical relations.109

Piaget's findings are consistent with those cited in the previous section in that the development of basic concepts of time and space are related to maturity. In addition, Piaget has indicated how the child develops a system that progresses through the different stages of growth until by the age of twelve or thirteen, he is able to rely on an inner sense of duration, and a spacial reference system.

Recent Theories and Studies

Carroll seems to agree with Piaget when he states that our concept of a time line is essentially a spacial concept whereby temporal succession is translated in terms of spacial order and distances.110 For a child, Carroll stresses, time does not flow in a straight line nor in any particular direction in a circular or spiral dimension, unless we are talking about the hands on a clock. One of the difficulties, Carroll continues, is that events of the past and the future cannot be immediately experienced, and it is very difficult to show a time line that includes historical events in the distant past and relate these to today and yesterday. Dallolio makes a similar point when she points out that much of the content students in social studies classes encounter is

109Holloway, p. 66. 110Carroll, p. 195.
about people, places, and conditions, remote in space to the student. The student with little sense of distance or time has a very difficult problem in understanding in a meaningful way these types of concepts. Even individual students within a given class may have different concepts from one another as they attempt to interpret time and space terms in their textbooks. Indeed, McAulay states that one fourth grade class may be more immature in historical time concepts than another fourth grade class which may need greater emphasis on place and space geography.

As has been stated above by Piaget and Carroll, as well as others, children are not born with clear perceptions of time and space. According to Ammons they seem to relate themselves to the when and where in a developmental sequence--a fact that Piaget had pointed out earlier.

Becker and Gantner studied first grade children's understanding of time concepts. The purpose of their study was to measure the effect of direct instruction of time concepts. Thirty students in the experimental group were matched by sex and intelligence with thirty students in a control group. The investigator concluded that direct instruction increased student understanding of time concepts significantly and that younger children made slightly higher gains than did older children.

111 Dallolio, pp. 146-49.
first graders. Older children in the control group, however, also made slight gains which the authors contributed to maturation. This finding agreed with earlier ones that stressed the importance of maturation in the child's development of time concepts.115

Second grade children's understanding of time relationships was studied by McAulay.116 One hundred and sixty-five second grade children, whose mean chronological age was seven years, four months, were asked to orally respond to questions dealing with time concepts associated with self, time concepts associated with the immediate environment, and time concepts associated with historical events. The author concluded that second grade children have a more clear understanding of the past than they do of the present and that they have a better understanding of the removed time environment than of the immediate and personal time environment. Other conclusions were that these children have little understanding of the continuity of time, but are capable of understanding periods of time if these are related to events rather than persons or places. It was further shown that time sequence relationship concepts are not clear to second grade children.

Fourth grade students' understanding of geographic space concepts was studied by Ammons.117 She equated two groups of fourth grade children. During their first three years in school one group used special reading materials which carried an unusually heavy burden of

115Wesley, Pistor, Piaget.


117Ammons, pp. 374-79.
geographic content, while the other group came through the usual curricula relatively barren of these concepts in their reading materials. A test seeking to get at the development of the geographic space concept indicated that there were no significant differences between the groups.

Chase studied fifth and sixth graders knowledge of time relationships. 118 Twenty-four questions requiring the placement of five items in each question in chronological order were given to 192 fifth grade children and 200 sixth grade children. The percentage of success in grade five was 34.7 percent and in grade six was 37.5 percent. The upper 27 percent in grade five scored 56.7 percent and in grade six 61.8 percent. The lower 27 percent of grade five scored 16.9 percent and in grade six the lower 27 percent scored 19.1 percent. The results of this investigation showed not only that few students on the average understood time relationships—less than 50 percent of those tested scored above 50 percent in the test—but also that there was a wide range of individual differences in understanding within the same grade level.

Davis attempted to discover whether children in grades four, five, and six could profit from instruction in concepts of time and space related to geographic time zones. 119 Two classes each of fourth, fifth, and sixth grade students were used in the study. One class at each grade level was designated as the experimental group and the other class as the


control group. The experimental group was taught a unit specifically on geographic time zones, and the control group was taught the regular program of studies, which included some materials on time zones. Davis found that all experimental classes profited from the instruction about geographic time zones. Sixth graders demonstrated significantly better understanding than the younger children, and fifth graders comprehended significantly more than the fourth graders. Davis concluded that although maturation was an important factor, deferment of instruction of space and time concepts with intermediate grade children may not be as necessary as was previously thought.

Dobbs also did a study involving the use of trade books written on the subject of time and systematic instruction in science and arithmetic about time. The study which involved sixth grade students found that although there was considerable duplication of the teaching of time concepts in sixth grade science, arithmetic, and social studies textbooks, systematic instruction was beneficial. After reading trade books written about the topic of time, students showed some gains in the development of time concepts, while systematic instruction about time concepts led to the greatest gains.

Dobbs also found that the pupils' ability to estimate intervals of time showed some sex differences. The boys demonstrated an ability to estimate intervals about time more accurately than did the girls. The girls, on the other hand, demonstrated a more extensive vocabulary of time words than did the boys. This finding seems to be in conflict with Friedman's study reported earlier which concluded that there were no sex differences.

120 Dobbs, "Time Sense and Chronology."
differences found in students' understanding of time and space concepts. 121

The results of Arnsdorf's study, which was confined to sixth grade students only, agreed with those of Davis.122 Arnsdorf used 563 sixth grade pupils to investigate the results of learning experiences which emphasized vocabulary presentation, time-line construction, and writing autobiographies. The experimental group was taught a seven week unit that consisted of special emphasis with reference to time concepts while the control group received no special instructions. Both groups used the same texts and had the same amount of time in social studies. Arnsdorf found that the experimental group improved significantly in their comprehension of definite and indefinite time-terms, the ability to recognize relative lengths of time between periods and to ascertain the similarity of time-distances with references to given events, skill in ordering dates, and competence in recognizing time absurdities. Arnsdorf concluded that children can profit from systematic instruction in time concepts, and thus disagreed with Pistor's conclusion that we can only wait for time and maturation to bring the desired changes that involve skills and knowledge.

Legere also concluded that children are able to know and use time concepts earlier than previous research indicated.123 In his study

121 Friedman, pp. 24-26.


a time relationship test was constructed which was divided into five parts: Vocabulary, Knowledge of Time Systems and Relations, Ability to Solve Time-Oriented Problems, Abstract Time Relationships, and Time Interrelationships. The test was produced in two forms and administered to 150 to 200 children in each grade level from grade four to eight. One form was administered to grades seven and eight and the other form was administered to grades four, five, and six. One of Legere's conclusions was that a progressive improvement of time understanding ability was noted throughout the grades within each sub-test. He also found that children who enter the fourth grade with a lower level of time understanding knowledge, improve more, proportionately, and more rapidly than the average or above average child. Finally, he concluded that as children progress through the grades their knowledge and utilization of time understandings become more alike, and group homogeneity of understanding becomes apparent.

Gill studied the understanding of indefinite time expressions by groups at different grade levels. A test was constructed which consisted of eighteen phrases such as, "In colonial days," "Until recently," "Several centuries ago." The students were asked to write before each of these phrases a definite date that comes to mind. The test was administered to sixty-eight college Juniors and Seniors, all prospective teachers of the social studies; fifty-six high school Juniors and Seniors enrolled in American history courses; sixty-eight eighth grade American history pupils, and sixty-two fifth grade American history pupils.

pupils. Gill's conclusions were as follows:

1. Indefinite time expressions were loosely interpreted at all grade levels.
2. The higher grade levels, particularly the college level, demonstrated a superior grasp of the meaning of indefinite time expressions. This tends to confirm the conclusion of other investigators that a time sense and maturity are closely related. On many items, however, there was no clear progression in understanding from the fifth to the eleventh or twelfth grade.
3. Words like "century" and "decade" were not clearly understood by many students.
4. Terms like "ancient times," "Middle Ages," and "modern times" have no precise meaning for many students and cause particular difficulty at the lower grade levels. 125

In his analysis of twenty-five books from four basal social studies, Arnsdorf found that the ratio of indefinite to definite terms was approximately four to one. 126 He also found that space terms were used more frequently than time terms and increased in frequency through the succeeding levels of a series. Over 90 percent of the space terms used were classified as indefinite. Thus, Arnsdorf has shown that indefinite time and space terms greatly outnumber the definite time and space terms, while Gill's study indicates that these indefinite terms are precisely the ones the students have trouble in understanding. Arnsdorf urged further investigation of the nature and frequency of use of time and space terms in social studies materials.

The studies cited in this section are both supportive and contradictory with regards to students' understanding of time and space concepts. Becker and Gantner's study indicated that direct instruction

125 Ibid., p. 456.

of time concepts significantly increased first grade students' understanding.\textsuperscript{127} Similarly Arnsdorf and Davis concluded that at the sixth grade level special teaching about time concepts led to significant improvement in the comprehension of these concepts.\textsuperscript{128,129,130} These findings are in direct conflict with those of Pistor, who concluded that training in history and chronology in grades four, five, and six had no effect on children's concepts of time.\textsuperscript{131} One of the questions asked in the present study is whether eighth grade students who are exposed to a great number of these concepts and not necessarily taught the concepts, understand them better than other eighth grade students who are exposed to fewer of these concepts. Ammon's study in the primary grades indicated that the greater exposure made no difference.\textsuperscript{132}

That children's understanding of time and space concepts improves as they progress through the grades is acknowledged by all the studies cited. Legere concluded that progressive improvement of time understanding ability was noted through all grades.\textsuperscript{133} Both Davis and Chase found that students in grades six understand time concepts better than did students in grade five.\textsuperscript{134} In addition, Davis found that students in grade five understood these concepts better than did students in grade four. Similar results were found by Friedman.\textsuperscript{135} Gill's study further

\textsuperscript{127}Becker and Gantner, pp. 389-92.
\textsuperscript{129}Davis, pp. 407-12.
\textsuperscript{130}Dobbs, "Time Sense and Chronology."
\textsuperscript{131}Pistor, pp. 107-12.
\textsuperscript{132}Ammons, pp. 374-79.
\textsuperscript{133}Legere.
\textsuperscript{134}Davis, pp. 407-12.
\textsuperscript{135}Friedman, pp. 21-31.
substantiated the findings discussed above when he found that as students progressed from the fifth grade to the college level, their understanding of indefinite time expressions improved.\textsuperscript{136} The present study seeks to determine the extent to which eighth grade students understand these concepts.

Another question raised by the literature is whether children understand the near in time and space better than they do the remote. McAulay concluded that second grade children understand better the removed time environment than the present time environment.\textsuperscript{137} In his study of children in grades four through six, Friedman found the exact opposite.\textsuperscript{138} Thus, it may be that as children progress through the early grades, and as they construct a time scale as noted by Piaget, the near in time and space becomes more comprehensive than does the remote.

**CONCEPTS DEALING WITH NUMERICAL QUANTITIES**

It is common knowledge among experts in elementary education that too many children fail to gain an adequate understanding of the numerous concepts contained in content subject textbooks just by reading the textbooks in question.

The words which compose the terminology of geography and history are necessary to a rudimentary knowledge of the social studies. Arithmetical statistical, and time concepts are needed and are represented by words.\textsuperscript{139}

Gabel stated that among words that have a great range of meaning

\textsuperscript{136}Gill, "Indefinite Expressions," 344-46.

\textsuperscript{137}McAulay, pp. 23-24.

\textsuperscript{138}Friedman, pp. 337-42.

\textsuperscript{139}Charlene W. Smith, "Factual Reading Materials," 443.
are those denoting quantity.\textsuperscript{140} He further stressed that social studies materials employ many concepts of time, area, distance, and size which must be expressed in quantitative terms. The primary purpose of his study was to compare students' understanding of definite and indefinite quantitative terms. As a result of testing over 1600 students in grades six, eight, ten, and twelve, he found that as students progressed in these grades their understanding of these concepts improved significantly. However, he also found that their scores on the test dealing with definite quantitative terms was higher than their scores on the test dealing with indefinite concepts. Out of a possible total score of eighty, the highest mean score for the definite portion of the test was 54.9, and for the indefinite portion of the test 44.0. Thus, the students understood little more than half of the definite concepts and less than half of the indefinite concepts. Gabel also found that there was a wider increase in correct responses between grades six and eight than between eight and ten and between ten and twelve. At the eighth grade level the highest mean score for definite concepts was 53.7 and for indefinite concepts was 44.1.

\textbf{The Child's Understanding of Quantity}

Flavell has described Piaget's investigation dealing with the child's understanding of quantity.\textsuperscript{141} These studies suggest the

\textsuperscript{140}Otto J. Gabel, "The Effect of Definite Versus Indefinite Quantitative Terms Upon the Comprehension and Retention of Social Studies Materials," \textit{Journal of Experimental Education}, IX (December, 1940), 177-86.

\textsuperscript{141}Flavell, pp. 298-303.
conclusion that children's concepts begin by being confused and undifferentiated in the child's mind, and gradually emerge as separate, stabilized quantity concepts. Whereas in the beginning the child does not differentiate matter, weight or volume as being distinct from one another, the child slowly develops the concept of conservation of matter and still later, the concepts of weight and volume.

Piaget's conclusions have been in agreement with those of other writers. Even before Piaget's studies dealing with quantities, Wheeler and Perkins emphasized that learning arithmetic begins with the child's undifferentiated concept of number, size, magnitude, and quantity.142 They added that at first the child's quantitative world contains no ideas of specific sizes or quantitative value. His first differentiation is into "more" or "less," and a gross differentiation of size or range. Douglass stressed that kindergarten children with few exceptions do not have accurate concepts of numbers above four.143 Their concepts of numbers above four, he added, are so indefinite that rarely can they correctly estimate numbers above four as often as three times in five.

Robinson studied first grade children's understanding of the principles of conservation, seriation, and categorization as these are defined by Piaget.144 Her sample was composed of ninety-nine first grade pupils randomly selected from ten elementary schools. The children


were tested on twelve experiments designed by Piaget and the Greater Cleveland Mathematics test. Robinson concluded that many first grade children did not have the ability to conserve, to seriate, or to categorize, that children who conserve when dealing with one type of material, do not necessarily do so when dealing with another type of material, and that a wide range of individual differences exist among children in reference to these concepts.

As a result of his analysis of Piaget's work, Copeland, like Piaget concluded that the concept of conservation cannot be accelerated. In one experiment, a six year old child is asked to count a set of six objects, a task which he can do quite easily. If a second set of the same number of objects is spaced apart further than the first set, the child states that it is more. For this child the concept of number is still meaningless. Copeland stresses that the child must first develop to the stage of conservation of number, usually six and a half to seven years of age before he can be taught the meaning of number. Not until the child is nine or ten years old is he usually able to use terms such as "all" or "some" in a logical sense for classification. Conservation of volume is not achieved until the child is eleven or twelve.

Even by the time they are in the third grade, children's understanding of the quantitative terms expressed in their social studies reading material is confused. Bedwell found that for third graders both definite and indefinite terms were found to be of differing degrees of

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The children demonstrated that it was possible to have a factual knowledge of a term without having a functional concept of the same term. Bedwell concluded that the quantitative concept load in the third reader level was too heavy for the children and that mere verbalism resulted on the part of the children. Bedwell suggests that definite and indefinite terms for quantity were misinterpreted because children lacked concepts based on experience.

Russell's study gave further evidence of the difficulty young children have in grasping concepts dealing with numbers. Using piles of blocks and asking certain types of questions, Russell interviewed twenty-nine children ranging in ages from four to eight to discover their understanding of quantitative situations involving the concepts of "more" and "less," the limits perceptually beyond which they could not make decisions, and the manner in which they attempted to make distinctions between quantities. An analysis of Russell's data indicated that the child's first concept of number is "manyness" from which the quantity and serial aspects only gradually differentiate. He found that differentiation is a gradual process which at the seven year old level does not reach the adults' conception of the cardinal and the ordinal ideas of number. He also found that the cardinal and ordinal number concepts develop simultaneously. Russell concluded that the child of four and


one-half to five years of age readily understands the terms "most," "both," and "biggest," but does not comprehend words denoting "same" or "equal." The child of seven, similarly, is able to use such terms as "many," "most," or "more," but is not able to comprehend the words "same" or "equal."

Earlier, Renwick had found that even children of ten and twelve years of age had difficulty with the concept of "equal." 148 He found that a mathematical expression the parts of which are connected by the sign of equality is interpreted by these children as merely an instruction to perform the process preceding the sign. He concluded that the term "equal" means the "same" or "alike" or is used in connection with resemblances where neither degree nor quantity is involved.

Waldo's study involved a broader scope of students' understanding of quantitative expressions. 149 The purpose of his study was to determine the extent to which the quantitative expressions used in fifth grade social studies materials were understood by the students. A page by page analysis of the materials was made and over 2,829 quantitative expressions were found. The author then constructed a forty-three question multiple-choice test using some of these expressions, and the test was administered to 1,558 fifth grade pupils in the Des Moines Public Schools. An analysis of the results of the test showed that most


of the students marked correctly only 54.3 percent of the test items. The expressions most frequently answered correctly by the students were "scarce," "empty-handed," "adequate," "plentiful," "abundance," "shallow," "bank-full," and "centuries." Those expressions with the lowest percent of correct answers were "square miles," "degrees," "horizontal," "score," "fathom," "average," and "decade."

In a similar study done at the fourth and sixth grade levels, Jensen constructed a test to measure the pupils' understanding of quantitative concepts. Using a sample of 201 fourth graders and 206 sixth graders, Jensen found that there was no significant differences in the ability of boys and girls to understand quantitative concepts. On the test, which contained fifty-six items, fourth grade students had a mean of 17.42 with a standard deviation of 6.40, while sixth grade students had a mean of 25.88 with a standard deviation of 9.41. Thus, the percentage of correct responses by the typical fourth grader was about 30 percent and by the typical sixth grader, about 50 percent. Important as this study was, the results would have been even more helpful had the sixth grade students been tested on concepts found in sixth grade texts rather than those found in fourth grade texts, since they are not studying fourth grade materials. Thus, Jensen found the extent to which sixth grade students understand quantitative concepts found in fourth grade textbooks, but he did not find how well they understand the quantitative concepts found in textbooks at their own grade level.

At the sixth grade level, Muscio investigated the relationships between sixth-grade pupils' quantitative understanding and mental

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150 Jensen, "Quantitative Concepts."
abilities, achievements, and attitudes.\textsuperscript{151} Using a sample of 413 students, Muscio found a significant sex difference in favor of boys on the measure of quantitative understanding. He also found that quantitative understanding is highly correlated to mathematical achievement, reading, and I.Q.

Coffing also did a study concerning the relationship between reading and arithmetical ability.\textsuperscript{152} Her study involved 355 pupils in each half grade, grades four through eight. Grade four B was the lowest grade and grade eight A was the highest. Students were given the Paragraph Meaning and Arithmetic Reasoning tests of the New Stanford Achievement Test, Advanced Form W, and the Pearson product-moment method was used for computing the correlations. The coefficients of correlation between the two tests are shown in Table 1 below.

<table>
<thead>
<tr>
<th>Grade</th>
<th>r</th>
<th>Grade</th>
<th>r</th>
</tr>
</thead>
<tbody>
<tr>
<td>4B</td>
<td>.62</td>
<td>6A</td>
<td>.64</td>
</tr>
<tr>
<td>4A</td>
<td>.42</td>
<td>7B</td>
<td>.53</td>
</tr>
<tr>
<td>5B</td>
<td>.67</td>
<td>7A</td>
<td>.38</td>
</tr>
<tr>
<td>5A</td>
<td>.08</td>
<td>8B</td>
<td>.33</td>
</tr>
<tr>
<td>6B</td>
<td>.50</td>
<td>8A</td>
<td>.77</td>
</tr>
</tbody>
</table>

\textsuperscript{151}Muscio, pp. 258-62.

Although Coffing points out that the greatest differences occur in the fifth grade where the five B correlation is .67 and the five A only .08, no reason is given for this difference. Neither is there any explanation given (for example, the sample of only one class at each grade level is insufficient) for the wide variances within and between the different grade levels. Nevertheless, the author concluded that because half of the correlations are .50 or above, there is a considerable positive relation between the score made in paragraph meaning and arithmetic reasoning. She also concluded that in general, pupils making high scores in reading are the ones who make high scores in arithmetic, even though the correlations, when viewed as a series, are quite irregular.

Another study involving reading correlation was done by Artley, who administered the Cooperative Test Service, Test of Reading Comprehension, C7 to 242 eleventh grade pupils.\textsuperscript{153} The results of this test were correlated with the results of the Cooperative Test Service, Social Studies Abilities Test and the Progressive Education Association, Application of Principles Test 1.5. The results are given in Table 2, page 70.

The author concluded that in general, the ability to read material of a general informative type is associated with the ability to read a type of material more specifically related to the social studies area. He further concluded that at the eleventh grade level an adequate measure of comprehension in the social studies area may be made with a test of

\textsuperscript{153}A. Sterl Artley, "A Study of Certain Relationships Existing Between General Reading Comprehension and Reading Comprehension in a Specific Subject Matter Area," \textit{Journal of Educational Research}, XXXVII (February, 1944), 464-73.
general reading comprehension.

Table 2
Correlations Between Measures of the Several Components of Reading Comprehension and the Criterion Measure of Reading Comprehension in the Social Studies

<table>
<thead>
<tr>
<th>Factor</th>
<th>r</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Ability to Obtain Facts</td>
<td>.732</td>
</tr>
<tr>
<td>2. Ability to Organize</td>
<td>.772</td>
</tr>
<tr>
<td>3. Ability to Interpret</td>
<td>.827</td>
</tr>
<tr>
<td>4. Ability to Generalize</td>
<td>.729</td>
</tr>
<tr>
<td>5. Ability to Perceive Logical Relations</td>
<td>.691</td>
</tr>
<tr>
<td>6. Ability to Evaluate Arguments</td>
<td>.576</td>
</tr>
<tr>
<td>7. Command of General Reading Vocabulary</td>
<td>.735</td>
</tr>
<tr>
<td>8. Command of Social Studies Vocabulary</td>
<td>.741</td>
</tr>
</tbody>
</table>

At the sixth grade level, however, somewhat different results were found. Fay collected test data for 384 sixth grade pupils through administration of the following tests:

Test of mental ability:

Stanford-Binet Intelligence Test, Form L.

Tests of reading ability:

Gates Basic Reading Tests, Types B and C.
Stanford Achievement Test--reading section.
Iowa Every-Pupil Test of Basic Skills, Test B.

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\(^{154}\) Leo C. Fay, "The Relationship Between Specific Reading Skills and Selected Areas of Sixth Grade Achievement," *Journal of Educational Research*, XLIII (March, 1950), 541-47.
Tests of subject-matter achievement:

Stanford Achievement Test--arithmetic, social studies and science sections.

A frequency distribution was then made of performance in each reading skill. The top one-third (ninety children) of each were classified as superior readers and the bottom one-third (ninety children) as inferior readers. The superior and inferior readers in each reading skill were compared on arithmetic, social studies, and science achievement, with mental and chronological ages statistically controlled. Fay concluded that superior readers were found to achieve no better in arithmetic than did inferior readers when chronological and mental ages were controlled but did achieve better in the reading of maps, charts, tables, and globes. This was true for all reading skills investigated. This finding was in direct conflict with Coffing's study and that of Muscio cited above, which found that there was a high correlation between the scores of pupils who do well in math and the scores of those who do well in reading. Fay also concluded that in some areas of social studies, such as predicting outcomes of given events, understanding precise directions, general comprehension, and the reading of maps, graphs, and charts, superior readers achieved better at the 1 percent level of significance than did inferior readers. The finding is consistent with those of Artley described above. On the other hand, Fay found that superior readers in using references, an index, and a dictionary were found to achieve no better in social studies than did readers inferior in these abilities.

The preceding investigations analyzed students' understanding of quantitative concepts and indicated that students, particularly at the
elementary level, have considerable difficulty understanding these concepts. Studies by Robinson, Wheeler, and Perkins indicated that up to grade one children have a poor concept of number while Russell found that even up to age seven, children have trouble understanding the concept of "same" or "equal." Even children ten and twelve years of age had difficulty with the concept of "equal." Bedwell concluded that third grade students had a poor understanding of definite and indefinite terms. Another study revealed that as students progressed from the elementary grades through high school their understanding of quantitative concepts improve, although even in grade twelve, they understand definite quantitative concepts better than they understand indefinite concepts of this type. Other studies indicated that students in grades four, five, and six, for the most part, understood less than 50 percent of the quantitative terms encountered in their textbooks. Jensen further found that there were no sex differences in student understanding of these concepts. Some investigators examined correlations among scores given in tests on math, reading, intelligence, and social science understandings. Muscio found that quantitative understanding is highly correlated to math, reading, and intelligence. Other high correlations

157 Wheeler and Perkins, Mental Development.
158 Russell, pp. 170-74.
159 Bedwell, "Comprehension of Concepts." 160 Gabel, pp. 177-86.
161 Waldo, "Quantitative Expressions."
162 Jensen, "Quantitative Concepts."
163 Muscio, "Quantitative Understanding."
were reported between math and reading in grades five through eight and between social studies abilities and reading. However, some of these findings were contradicted by Fay's results which indicated that reading had a high correlation with some areas of social studies, but not with all areas of social studies, in grade six. Fay further reported that although superior readers do well in math, inferior readers do not.

STUDENT EVALUATION OF TEACHING

Another question raised by this study is whether there is a positive relationship between students' perceptions of teacher activities designed to teach quantitative concepts (PTA) and the students' understanding of these concepts.

Pupil evaluation of teaching is common at the university and college level. Some of these studies at the college level have focused on the relationship between student ratings of teachers and achievement. Bendig found that ratings of instructors were positively correlated with

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166 Fay, pp. 541-47.

the mean achievement of students on achievement tests.\textsuperscript{168} In a later study of thirty-six college chemistry teachers at Purdue, Elliot reported similar findings with correlations at the .05 level.\textsuperscript{169}

In addition to student evaluation of teaching at the collegiate level, student evaluation at the secondary level is also becoming common.\textsuperscript{170} In Kalamazoo, Michigan, part of the teachers' evaluation process includes the rating of the teacher by the student on a Student Opinion Questionnaire.\textsuperscript{171} In Georgia, 178 teachers with an average of 23.9 students each in nine secondary schools were evaluated by their pupils.\textsuperscript{172} The results of the study indicated that from the pupils' viewpoint, the experienced teacher was more knowledgeable and poised than was the beginning teacher. In San Mateo, California, 80 percent of the

\begin{itemize}
\item \textsuperscript{168}A. W. Bendig, "Student Achievement in Introducing Psychology and Student Ratings of the Competence and Empathy of Their Instructors," Journal of Psychology, XXVI (1935), 427-33.
\item \textsuperscript{171}"Ready? Let's Open That Can of Worms and Rate Teachers on How They Perform," American School Board Journal, CLXI (April, 1974), 40-43.
\item \textsuperscript{172}Joseph C. Bledsoe and Iva D. Brown, "Rate Perceptions of Secondary Teachers as Related to Pupils' Perceptions of Teacher Behavioral Characteristics," Journal of Educational Research, LXI (May, 1968), 422-29.
\end{itemize}
faculty of 113 teachers has volunteered to be evaluated by students.\textsuperscript{173}

Recently, at the junior high school level, student evaluation of teachers is also becoming a reality. Jacobson has described how she was evaluated by her English and social studies students using an instrument that she had devised herself.\textsuperscript{174} In a study by Somers and Southern, 593 junior high school students were asked to test the qualities of the "good" junior high school teachers.\textsuperscript{175} The same task was completed by the schools' two administrators and thirty-six teachers. A rank rho coefficient of .84 was obtained on the eight most frequently mentioned qualities listed by both groups. Thus, there was substantial agreement between students and their teachers as to the qualities of a good junior high school teacher. A rating scale based on these characteristics was developed and administered to classes of eight volunteer teachers. Somers and Southern concluded that junior high school students can reliably rate their teachers on the dimensions of teaching effectiveness.

In a review of the research on teacher evaluation, Moss has confirmed the findings above that students are competent to evaluate faculty, that student evaluations are not biased by the sex of the teacher, that a teacher's "ability to teach" or "ability to communicate" are positively


\textsuperscript{174}Joan Jacobson, "Should Students Evaluate Teachers?" Today's Education, LXII (May, 1973), 49.

related to student ratings, and that the results are as reliable as our better educational and mental tests.176

SUMMARY

Research reviewed in this chapter was organized into six sections. First, the selection and readability of social studies textbooks were reviewed. The conclusions drawn from this review were that social studies textbooks are written at a higher grade than is appropriate for the students for whom they are written, that the concept load and vocabulary load are generally excessive for students, and that even familiar terms become unfamiliar to students when they take on new meanings.

The second section of this review examined student understanding of social studies concepts in general. The studies reviewed indicated that not only are many unfamiliar terms and concepts presented to students in their textbooks, but also that these concepts are often poorly defined and inadequately developed. As a result, there is considerable question about the depth of student understanding of many of these concepts.

In the third section, the development of concept formation in children was examined. The studies done by Piaget, Rogers, Venacke, and others leave little doubt that concept attainment can be fostered by the child if he is exposed to concrete experiences and objects and to their relationships to each other.

The next section reviewed time and space concepts. The findings suggest, as Pistor states, that maturation may be the most important

factor in the ability of students to grasp these concepts. Yet the
studies by Friedman and by Oakden and Sturt conclude that even in grade
six, many students have considerable difficulty with these concepts.
Friedman further found that there were no sex differences in students'
understanding of these concepts and that there was a very low correlation
between I.Q. and understanding of these concepts. Some questions raised
by the studies cited involved the extent to which instruction facilitates
student comprehension and student understanding of the near in time versus
the remote in time.

Studies dealing with the child's understanding of quantity indicated that the child's concept of quantity progresses from an
undifferentiated concept of number, size, and magnitude, to a development
of the ability to conserve, seriate, and categorize. One of the biggest
difficulties that even children of ten and twelve years of age had was
with concepts such as "equal," "degrees," "average," and "decade." Other
investigations revealed that even upper elementary school children had
great difficulty in understanding quantitative terms and concepts, and
that sex was not a significant factor in students' understanding.
Finally, correlation studies involving quantitative concepts, reading,
and other factors were reviewed, and some disagreement was found in
studies dealing with the correlation between reading and social studies
abilities.

The last section of the review related to student evaluation of
teaching. It was noted that such evaluations are common at the collegiate
level and becoming more and more common at the senior and junior high
school level. A study by Somers and Southern concluded that junior high
school students can reliably rate their teachers on the dimensions of
teaching effectiveness.

In the chapter that follows, the method and procedures used in this investigation will be discussed.
Chapter 3

THE DESIGN AND PROCEDURE OF THE STUDY

The design and procedure of the study, briefly outlined in Chapter 1 will be presented below in detail under sections dealing with the following: (1) the setting of the study, (2) identification of the population, (3) research design and testing instruments, (4) content analysis, (5) hypotheses, (6) statistical procedure, and (7) summary.

SETTING OF THE STUDY

The setting of the study was in Solano County, California. Solano County is part of the Vallejo-Napa metropolitan area and is located midway between San Francisco and Sacramento. It has a population of approximately 177,100.1 The three school districts chosen for the study were Fairfield-Suisun Unified, Travis Unified, and Vacaville Unified. The combined population of Fairfield and Suisun City is 47,063 and that of Vacaville is 21,690.2 Travis Air Force Base has a population of 18,245.3


2Ibid., p. 10.

Fairfield is the seat of government for Solano County and is located six miles from Travis Air Force Base. Vacaville is ten miles from Fairfield and also ten miles from Travis Air Force Base. Although Travis Air Force Base has its own Unified School District, approximately 30 percent of the students attending school in Vacaville and Fairfield-Suisun have parents who are employed at the Air Force Base, as either military or civilian personnel. The proportion of parents in agriculture and related occupations is considerably less than those working in other occupations within the cities of Fairfield and Vacaville. The largest proportion of the parents in the districts are engaged in skilled or semi-skilled occupations and trades. The districts do, however, contain some professional workers such as teachers, dentists, and lawyers. Some residents also commute to the nearby larger cities of Vallejo, Sacramento, and San Francisco.

The investigator initially presented his study proposal on April 4, 1973 to Mr. E. T. Giugni, Superintendent, Fairfield-Suisun Unified School District, to Mr. Clarence E. Krawczak, Superintendent, Vacaville Unified School District, and to Mr. George Gammon, Superintendent, Travis Unified School District. After securing verbal permission for the study from Mr. Giugni, Mr. Krawczak, and Mr. Gammon, the investigator contacted the principals of the five seventh and eighth grade schools in the three districts to obtain their reactions to the study proposal. The five principals gave their approval of the study and each offered to permit

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his school to participate.

IDENTIFICATION OF THE POPULATION

The Schools

Fairfield-Suisun Unified School District has an enrollment in grades kindergarten through twelve of 11,868 students in twenty-four schools, only three of which are seventh and eighth grade schools. The population of these three schools range from 460 to 930, with a total population of 2,050.5

Vacaville Unified School District has an enrollment in grades kindergarten through twelve of 7,011 in thirteen schools, only one of which is a seventh and eighth grade school with a population of 1,066.6

Travis Unified School District has an enrollment in grades kindergarten through twelve of 3,963. The seventh and eighth grades at Travis are housed in a sixth through eighth grades middle school, which has a population of 1,079.7

Racial Composition

In Fairfield students attending the three seventh and eighth grade schools were from 75 to 78 percent Caucasian.8 Those with Spanish surnames comprised between 6 and 10 percent of the student populations; Blacks between 9 and 11 percent; and Orientals between 2 and 5 percent.

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6Ibid., p. 408.

7Ibid., pp. 407-408.

These percentages could be compared with an overall district racial and ethnic distribution that was 75 percent Caucasian, 8 percent Spanish surnames, 10 percent Negro, and 4 percent Oriental.  

In Vacaville, students attending the seventh and eighth grade school were 83 percent Caucasian. Those with Spanish surnames comprised 11 percent of the student population; Blacks 4 percent, and Asian Americans 1 percent. These percentages could be compared with an overall district racial and ethnic distribution that was 84 percent Caucasian, 11 percent Spanish surnames, 3 percent Blacks, and 2 percent Asian American.

At Travis Air Force Base, students attending the seventh and eighth grade school were 76 percent Caucasian. Those with Spanish surnames comprised 4 percent of the student population; Blacks 14 percent, and Asian Americans, 3 percent. These percentages could be compared with an overall district racial and ethnic distribution that was 75 percent Caucasian; 5 percent Spanish surnames; 14 percent Blacks, and 3 percent Asian Americans.

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9Ibid.


13Ibid.
Median Incomes

The median income of residents living within Solano County in 1969 was $9,880.14

Selection of Grade Level

Eighth grade students were chosen because, except for the studies by Gill, few studies above the sixth grade level have been made that are concerned with students' understanding of quantitative terms.15

The eighth grade level was also selected because most tests on concept formation are given to younger children.16 Peel further states that tests of concept formation given to older groups are likely to test a growing element of concept attainment, "since by now the student has available the logical machinery of classifying and relation finding and most of the basic first-order concepts required for action and perception."17 Therefore, eighth grade students should be better able to understand quantitative concepts used in their texts than do younger children.

The Sample

For the purpose of this investigation it was desirable to obtain

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15Clark C. Gill, "Indefinite Quantitative Concepts; A Fractured Fact."


17Ibid.
a sample which met certain predetermined conditions set by the nature of the study. First, to prepare the evaluative instruments it was necessary that the schools involved be using the two basic U.S. History textbooks. Second, it was necessary to select a sample for which acceptable reading and math achievement scores were available to the investigator. All five of the schools selected met these conditions.

Within the five schools different combinations of the two textbooks, *Quest for Liberty* and *We the People* were being used. In the school at Travis Air Force Base only *Quest for Liberty* was being used, with all twelve sections of students. In one of the Fairfield schools only *We the People* was being used with all four sections of students. In the other two Fairfield schools both textbooks were being used in each of the eighteen sections being taught. In the Vacaville school *Quest for Liberty* was being used exclusively for four sections, and a combination of the two textbooks was being used in three other sections.

The sample consisted of the following:

<table>
<thead>
<tr>
<th>Number of Sections</th>
<th>Text</th>
<th>School and District</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td><em>We the People</em></td>
<td>Green Valley-Fairfield</td>
</tr>
<tr>
<td>2</td>
<td><em>Quest for Liberty</em></td>
<td>Golden West-Travis</td>
</tr>
<tr>
<td>2</td>
<td><em>Quest for Liberty</em></td>
<td>Willis Jepson-Vacaville</td>
</tr>
<tr>
<td>2</td>
<td>both</td>
<td>Sullivan-Fairfield</td>
</tr>
<tr>
<td>2</td>
<td>both</td>
<td>Crystal-Fairfield</td>
</tr>
</tbody>
</table>

At Green Valley school all four classes were used. At the other four schools, classes were selected at random by drawing from a hat slips of paper with the different section numbers written on them. Sixteen percent of the experimentally accessible population comprised the sample.

Eighth grade social studies classes in all four schools were
grouped heterogeneously. Actual placement of students in classes was done through a data processing computer. The amount of time devoted to eighth grade U.S. History classes daily in the various schools ranged from forty-three minutes to fifty minutes. Each school district had curriculum guides which stated the social studies objectives but no systematic techniques were used to control the methodology used to facilitate achievement of the objectives. No specific objective in any of the guides was related to the obtainment of knowledge of quantitative terms.

RESEARCH DESIGN AND TESTING INSTRUMENT

Textbook Selection

In the fall of 1972, the State of California adopted new social studies texts in grades five through eight for a four-year period.\textsuperscript{18} In grade eight the following titles for U.S. History were selected: \textit{Quest for Liberty: Investigating United States History}, and \textit{We the People}. According to the publishers, \textit{We the People}, has a reading level that ranges from 4.5 to 5.5, as determined by the Dale-Chall formula.\textsuperscript{19} \textit{Quest for Liberty} has a reading level of approximately 6.8, as also determined by the Dale-Chall formula.\textsuperscript{20}

In addition to differences in reading level, the textbooks had other differentiating characteristics. \textit{Quest for Liberty} was 643 pages long while \textit{We the People} was 423 pages long. Furthermore, the print in \textit{We the People} was larger and darker than that in \textit{Quest for Liberty}. The average number of words per line in \textit{We the People} was 6.5 and in \textit{Quest

\textsuperscript{18}California State Department of Education, "Minutes."

\textsuperscript{19}Simpson, "Letter."

\textsuperscript{20}Wright, "Letter."
for Liberty 9.5. The researcher estimates that the total number of words in *We the People* is about 64,000 compared to 180,000 words in *Quest for Liberty*. Two additional characteristics of the text should also be noted. The average length of chapters in *We the People* was about fourteen pages and each chapter was divided into three distinct sections. The average length of chapters in *Quest for Liberty* was about thirty pages with virtually no separation of the chapter into sections. It was also apparent that the authors of *Quest for Liberty* intended students to go into much greater depth than did the authors of *We the People*. At the end of each chapter in *Quest for Liberty* were seven review questions, seven "Think it over" questions, and seven research questions. In *We the People*, at the end of each three or four page section, the authors would pose one question such as "What do you think . . . ."

Content Analysis Instrument

The content analysis instrument was developed around the seven categories originated by Jarolimek and Foster.21 These categories were used to determine the nature and frequency of the quantitative concepts or terms used in the two textbooks. Each category was defined with specific indicators.

A quantitative concept was defined as any reference or phrase in a social context that designated or implies an increase or decrease in amount; any phrase, term or word concerned with measuring, estimating, or enumerating.22 Thus, in this study the phrase "quantitative concept"

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21 John Jarolimek and Clifford Foster, "Quantitative Concepts."

22 Ibid., p. 437.
and "quantitative term" are used interchangeably. Based on this definition the following major categories with indicator examples for each category were listed:

I. **Specific References to Quantities**
   Indicator examples: 300 pounds; 27,000 deaths; $30,000.

II. **Indefinite References to Quantities**
   Indicator examples: a few Frenchmen; some tribes; many religious groups.

III. **Specific References to Space**
    Indicator examples: 600 miles; 160 acres; 6 inches.

IV. **Indefinite References to Space**
    Indicator examples: thousands of square miles; a few miles; a large farm.

V. **Specific References to Time**
   Indicator examples: six months ago; eleven o'clock; four days; forty-hour week.

VI. **Indefinite References to Time**
    Indicator examples: a few years; months; the years ahead.

VII. **Graphic Presentation of Quantitative Data**
    Indicator examples: picto-graphs; bar graphs; population symbols; charts; and time lines.

In the present investigation the various types of data under each category were further broken down into sub-categories. For example, under the category "Specific References to Time," the data could be further separated as to type of time units (years, days, hours, months, centuries, etc.). For purposes of tabulation each category was listed separately on file cards. As the tabulation proceeded, a tally was
placed on the appropriate card each time a quantitative concept occurred in the textbook. To insure accuracy, each term was circled as it was tabulated. In this manner both textbooks were analyzed in their entirety. The nature and frequency for each category will be reported in Chapter 4. In addition, total frequencies for all categories were recorded and reported for both textbooks.

Construction of the Test on Quantitative Concepts

To determine and compare students' knowledge of the quantitative concepts used in their U.S. History textbooks a multiple choice examination was used. The preceding analysis of social studies textbooks provided the basis for item selection. In order to provide a basis for comparing the results of this examination with that given by Jensen in an earlier study, five items per category were used in the construction of the test.23

Actual test questions were constructed by using quantitative terms common to both textbooks. Each test question was preceded with the desired term in context (the context was quoted directly from the text). When this was not possible, the investigator supplied the contextual material himself, adhering to the language of the textbook authors as closely as possible. The question, correct response, and distractors were constructed using similar vocabulary. The resulting test was referred to as the Test on Quantitative Concepts.

Construction of Perceived Teacher Activity Instrument

In order to determine the extent to which quantitative concepts are taught or discussed in social studies classes, a perceived teacher activity instrument was constructed. After discussing with various social studies teachers (not the ones whose classes were being tested) the types of classroom activities that might be related to quantitative concepts, the investigator constructed eleven statements that might describe such an activity. The students were requested to put a check mark for each statement in one of three columns titled "Often," "Sometimes," or "Never." For example, one question was, "We made time lines and/or discussed the meaning of them."

In addition, the teacher was requested to fill out the Perceived Teacher Activity check sheet, so that his response could be compared with those of his students.

The Perceived Teacher Activity check sheet was considered as Part II of the Test of Quantitative Concepts.

The Pilot Study

The written Test on Quantitative Concepts was evaluated by administering the first of two pilot tests to one class of eighth grade students who were using both textbooks, We the People and Quest for Liberty. This pilot test was conducted to evaluate: (1) clarity of the test items, (2) difficulty of the items, and (3) time requirements and ease of administration. Twenty-seven students were involved in this first pilot test.

Of the twenty-seven students taking this first test, twenty-five finished the test. A study of the item analysis revealed that ten of the
items had a discrimination value of below .25. Items having an index lower than .25 are considered as poorly discriminating.24

Reliability was computed using the Kuder Richardson Formula 21, in which \( r = .89 \).

A reliability coefficient of .89 was considered satisfactory because when a test is intended only for use in studying groups a reliability coefficient as low as .75 is sufficient.25

The standard error of measurement was 2.75. Thus, the probability is two to one that any individual's true score did not differ from his obtained score by more than 2.75.26

A second revised pilot test was administered to another class of twenty-eight students. Changes made in the test included revisions in items whose discrimination values were low, and the elimination of five items to shorten the test from forty to thirty-five items. All twenty-eight students completed the second pilot test. Only two items had discrimination values lower than .25.

Reliability was again computed using the Kuder Richardson Formula 21, in which \( r = .82 \). The standard error of measurement on the second pilot test was 2.80.

The final test was then constructed with minor adjustments used to refine the two low discriminating items.

The two classrooms in which the tests were administered were selected by the principal at the Willis Jepson school in Vacaville.


25Ibid., p. 92. 26Ibid., p. 91.
Consent of the classroom teacher was secured.

Content validity was established by submitting a revised copy of the pilot test to each of the mathematics department chairmen of the five schools involved in the study and explaining the purpose of the test. After examining the test, the department chairmen agreed that it appeared to measure students' understanding of quantitative concepts.

Administration of the Test to the Students

Permission to conduct the study in the Fairfield-Suisun, Travis and Vacaville school districts was granted, April 4, 1973. On August 22, 1973 the investigator made arrangements with the building principals to conduct the testing during the latter part of the fall semester. The week of January 21 through 25 was agreed on. These dates were submitted to the teachers for their approval and the actual testing took place on the dates agreed upon.

All testing was done by the investigator. During the actual administration of the test, the regular classroom teacher was not present.

The directions which were read by the investigator to the students included the definition of the term "quantitative concept." Students were given an opportunity to ask questions. Once they began the test no questions were allowed other than pronounciation of proper names.

Prior to the test neither the teachers nor the students involved were told the exact nature of the test. Instead, both teachers and students were told that the test would deal with the students' understanding of what they had learned in social studies. Therefore, it was unlikely that any correlation between variables investigated in this study had been affected in a systematic manner by any specific
instructional methodology.

The test was not given on a timed basis and all students were given time to finish. Some students completed the test in twenty-five minutes while others took the entire period to complete the test. The average time was thirty to thirty-five minutes. To prevent students who had finished early from distracting others, teachers had been requested beforehand to provide the students with reading materials when they had finished the test.

The original sample contained 299 eighth grade students from five different schools. One hundred students were using *Quest for Liberty*, 103 students were using *We the People*, and ninety-six students were using both textbooks. The final sample was limited to 263 students: ninety-one students using *Quest for Liberty*, eighty-nine students using *We the People*, and eighty-three students using both textbooks. If a reading or a mathematics achievement score was not available for a student, his score was necessarily eliminated from the sample. No achievement scores were available for nine students using *Quest for Liberty*, fourteen students using *We the People*, and thirteen students using both textbooks.

**Reading Test Scores**

The testing instrument used in the study to measure subjects' reading comprehension, vocabulary and math concepts was the *Comprehensive Tests of Basic Skills, Reading (CTBS)*, Form Q, Level 4, for grades eight through ten.27

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27 *Comprehensive Tests of Basic Skills, Form Q, Level 4* (Monterey, California: California Test Bureau, Del Monte Park, 1970).
According to the Technical Manual for the Comprehensive Tests of Basic Skills, Reading, Form Q, Level 4 had an alternate form reliability of .87 and .83 and an internal consistency of .88 in the Vocabulary subtest. In Comprehension, the test had an alternate form reliability of .84 and .76 and an internal consistency of .89. In math concepts the alternate form reliability was .77 and .84 and the internal consistency was .82.28

According to the Technical Manual, the validity of the Comprehensive Test of Basic Skills was derived from correlating raw scores on certain tests of CTBS, Form Q, with scores on the California Achievement Tests, Form W.29 The correlation coefficient in Reading Vocabulary at grade 7.8 is .36. The correlation at the same grade level in Reading Comprehension is .87. In math concepts the correlation is .79.

Methods for Treatment of Data

The statistical procedures used in this study apply to the treatment of the data collected by the administration of the Test of Quantitative Concept Understanding. The assigned variables were reading achievement scores in vocabulary and comprehension, math concept achievement scores, and grade point averages.

Because the test was a multiple-choice examination, the students were directed to choose what they felt was the best answer for each item. Each child recorded his answer on a standard answer sheet and the test


29Ibid., p. 60.
was machine scored.

Each student was assigned an identification number through the prenumbering of the answer sheets. The student identification number was then used throughout the analysis of the data.

HYPOTHESES

The null hypotheses to be tested for this study are:

H₁: After statistically controlling for the variables of vocabulary and comprehension achievement scores, math concept achievement scores, and grade point averages, eighth grade students using a United States History textbook which has a greater number of quantitative concepts do not perform better than eighth grade students who are using a United States History textbook which has fewer quantitative concepts on a test designed to measure the extent to which students understand quantitative concepts used in their United States History textbooks.

H₂: After statistically controlling for the variables of vocabulary and comprehension achievement scores, math achievement scores, and grade point averages, eighth grade students using a textbook with many quantitative terms and a textbook with fewer quantitative terms do not perform better than eighth grade students who are using only one of the textbooks, on a test designed to measure the extent to which students understand quantitative concepts used in their United States History textbooks.

H₃: There is no difference between the scores of eighth grade
boys and the scores of eighth grade girls on a test designed to measure the extent to which students understand quantitative concepts used in their United States History textbooks.

$H_4$: There is no positive correlation between reading achievement and the understanding of quantitative concepts.

$H_5$: There is no positive correlation between mathematical achievement and the understanding of quantitative concepts.

$H_6$: There is no positive correlation between perceived teacher activity and the understanding of quantitative concepts.

STATISTICAL PROCEDURES

A content analysis of each of the two United States History textbooks was made and a Test on Quantitative Concepts was constructed. After all the subjects had been randomly selected by class within the four schools, grade point averages and achievement test scores in reading comprehension, vocabulary, and mathematics achievement were obtained from school records for each student. The test on Quantitative Concepts was then administered. An analysis of covariance was then used to equate the groups on potential differences in reading, math, and grade point averages and to eliminate potential bias. Subjects' knowledge of quantitative concepts as measured by the Test on Quantitative Concepts was the dependent variable, with the covariants being reading comprehension, vocabulary and mathematics achievement, and grade point averages.

Analysis of covariance was also used to test the hypothesis about differences in understanding quantitative concepts because of sex.

To test the hypotheses about correlation between reading
achievement and the understanding of quantitative concepts, correlation between mathematical achievement and the understanding of quantitative concepts, and correlation between perceived teacher activity and the understanding of quantitative concepts, the Pearson-r Correlation coefficient was computed.

Test scores and other data needed for statistical computations were typed into a terminal at the University of the Pacific. The .05 level of statistical significance was required.

SUMMARY

The third chapter of this report reviewed: (1) the setting of the study, (2) identification of the population, (3) research design and testing instruments, (4) content analysis, (5) hypotheses, and (6) statistical procedures.

The setting of this study was in three unified school districts in Solano County, California. By random sampling, 299 students were chosen from the four seventh and eighth grade schools in the three districts. Schools were similar in racial composition and in median income of residents living in each of the districts.

A content analysis of the two United States History textbooks used by the sample population was made and an instrument was constructed by the investigator to evaluate eighth grade students' comprehension of quantitative concepts. The test consisted of thirty-five terms based on the quantitative concepts used in the eighth grade textbooks. Each test question presented a quantitative concept in written context followed by five alternative definitions of that concept from which the student was to determine the best answer. Each item was scored on the basis of
(+1) for a correct response and (0) for an incorrect response. Students were tested in their classrooms by the investigator. Other scores used in the study were the Reading and Math Achievement scores from the Comprehensive Test of Basic Skills, students' grade point averages, and Perceived Teacher Activity scores.

Revisions and necessary refinements of the test were made on the basis of two pilot studies in one of the school districts.

Six hypotheses were presented for acceptance or rejection at the .05 level of significance.

Chapter 4 of this report will present an analysis of the statistical data drawn from this study.
Chapter 4

RESULTS OF THE STUDY

INTRODUCTION

Data gathered to test eighth grade students' understanding of quantitative terms expressed in their social studies textbooks will be presented in two parts. First, tables will be presented illustrating the number and type of quantitative concepts or terms expressed in each of the textbooks. The format of these tables will be based upon the seven categories and the indicator examples developed by Jarolimek and Foster.\(^1\) The second part of the chapter will be presented in terms of an analysis of covariance using achievement scores and grade point averages as the covariates and text and sex as the independent variables.

Results and Tables of Analysis of Quantitative Terms

The two textbooks used were *Quest for Liberty*, which had approximately 180,000 words and *We the People*, which had approximately 64,000 words.

Table 3, page 99, deals with the first of the seven categories examined, specific references to quantities. An examination of the table reveals that although *Quest for Liberty* (hereafter referred to as *Quest*) had approximately three times as many words as *We the People* (hereafter

\(^1\)Jaolimek and Foster, pp. 437-42.
Table 3

Category 1: Specific References to Quantities in Two Eighth Grade United States History Textbooks

<table>
<thead>
<tr>
<th>Quantitative concept indicators</th>
<th>Frequency We the People</th>
<th>Frequency Quest for Liberty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whole Number</td>
<td>165</td>
<td>749</td>
</tr>
<tr>
<td>Amounts of Money</td>
<td>13</td>
<td>166</td>
</tr>
<tr>
<td>Fractions</td>
<td>1</td>
<td>17</td>
</tr>
<tr>
<td>Ounces</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Percentage</td>
<td>0</td>
<td>13</td>
</tr>
<tr>
<td>Ratio</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Pounds</td>
<td>0</td>
<td>21</td>
</tr>
<tr>
<td>Gallons</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Quarts</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Dozen</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Bushels</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Tons</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>180</td>
<td>986</td>
</tr>
</tbody>
</table>

referred to as People, it had more than five times the number of specific references to quantities. Students using People would encounter three specific references to quantities every 1,000 words, while the students using Quest would encounter 5.5 of these terms for every 1,000 words. Moreover, out of twelve indicator examples, People used only four: whole numbers, amounts of money, fractions, and ounces. Thus the students using Quest would be encountering not only more specific references to quantities but also more types of these references.
Category 2 dealt with the nature and frequency of indefinite references to quantities. The findings are shown in Table 4, below.

Table 4

Category 2: Indefinite References to Quantities in Two Eighth Grade United States History Textbooks

<table>
<thead>
<tr>
<th>Quantitative concept indicators</th>
<th>Frequency We the People</th>
<th>Frequency Quest for Liberty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whole Number References</td>
<td>71</td>
<td>105</td>
</tr>
<tr>
<td>Many, Much</td>
<td>448</td>
<td>532</td>
</tr>
<tr>
<td>Some</td>
<td>191</td>
<td>323</td>
</tr>
<tr>
<td>More, Less</td>
<td>148</td>
<td>115</td>
</tr>
<tr>
<td>Most</td>
<td>151</td>
<td>204</td>
</tr>
<tr>
<td>Few</td>
<td>59</td>
<td>126</td>
</tr>
<tr>
<td>All</td>
<td>86</td>
<td>206</td>
</tr>
<tr>
<td>Rank</td>
<td>95</td>
<td>203</td>
</tr>
<tr>
<td>Little (not very much)</td>
<td>26</td>
<td>31</td>
</tr>
<tr>
<td>Large, Small (many, few)</td>
<td>22</td>
<td>62</td>
</tr>
<tr>
<td>Amounts of Money</td>
<td>23</td>
<td>28</td>
</tr>
<tr>
<td>Wages, Income, Pay</td>
<td>22</td>
<td>26</td>
</tr>
<tr>
<td>Enough, Adequate, Plenty</td>
<td>20</td>
<td>13</td>
</tr>
<tr>
<td>Ratio</td>
<td>18</td>
<td>47</td>
</tr>
<tr>
<td>Great, Huge (many)</td>
<td>14</td>
<td>23</td>
</tr>
<tr>
<td>Several</td>
<td>10</td>
<td>32</td>
</tr>
<tr>
<td>Prices</td>
<td>9</td>
<td>7</td>
</tr>
<tr>
<td>Profits</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>Percent</td>
<td>7</td>
<td>43</td>
</tr>
<tr>
<td>Fractions</td>
<td>5</td>
<td>49</td>
</tr>
<tr>
<td>Surplus</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>Cost</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Roman Numerals</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>Majority</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>Rate</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Vast</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Miscellaneous, Ex.:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;Countless&quot;</td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td>&quot;Quota&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;Mesgre&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;Jumbo Size&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1,439</td>
<td>2,222</td>
</tr>
</tbody>
</table>

In this area there is a closer balance between the two books in the total
number of concepts encountered, although Quest still contains almost
twice as many references (2,222) as does People (1,439). However,
because of the shortness in the length of People, students would tend to
encounter 22.5 indefinite references to quantities every 1,000 words
while students using Quest, would tend to encounter 12.4 references
every 1,000 words. In addition, students using People encounter only
twenty-two of the twenty-seven types of indicators listed, while students
using Quest encounter all twenty-seven. Moreover, People students
encountered not only proportionately more indefinite references but in
five areas (more and less, enough, prices, profits, and cost) they
encountered numerically more of these concepts.

Both texts had considerably fewer references to specific quan-
tities than to indefinite quantities. People, for example, had only 180
specific references, but 1,439 indefinite references to quantities, or
almost eight times as many indefinite references as specific references.
Quest had only 986 specific references, but 2,222 indefinite references
to quantities or over twice as many indefinite references as specific
references.

Table 5, page 102, deals with the third category examined,
specific reference to space. An examination of the table reveals that
there are few references to space in either textbook, but particularly
in People, with only eight. Quest, which has ninety-nine references has
over twelve times as many as does People. Thus, in People there is on
the average one reference every 8,000 words, while in Quest there is one
reference every 1,800 words. Of the fourteen indicators listed, only
four are found in People.

Earlier it was pointed out that in the area of indefinite
Table 5

Category 3: Specific References to Space in Two Eighth Grade United States History Textbooks

<table>
<thead>
<tr>
<th>Quantitative concept indicators</th>
<th>Frequency</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>We the People</td>
<td>Quest for Liberty</td>
</tr>
<tr>
<td>Miles</td>
<td>4</td>
<td>42</td>
</tr>
<tr>
<td>Acres</td>
<td>2</td>
<td>20</td>
</tr>
<tr>
<td>Square Miles</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>Feet</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>Sections</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>Stories or Floors (in a building)</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Inches</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Square Feet</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>City Blocks</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Degrees of Longitude, Latitude</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Leagues</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Four-sided Figure</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Size of Lot</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Three-room House</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>8</strong></td>
<td><strong>96</strong></td>
</tr>
</tbody>
</table>

references to quantities there was a closer balance between the two textbooks than in the areas of specific references to quantities and that there were proportionately more references in People. A similar occurrence is revealed in the areas of specific and indefinite references to space. An examination of Table 6, page 103, indicates that Quest has less than
Table 6

Category 4: Indefinite References to Space in Two Eighth Grade United States History Textbooks

<table>
<thead>
<tr>
<th>Quantitative concept indicators</th>
<th>Frequency</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>We the People</td>
<td>Quest for Liberty</td>
</tr>
<tr>
<td>General Size of an Area</td>
<td>112</td>
<td>177</td>
</tr>
<tr>
<td>General Distance or Height</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>Comparison in Size of Areas</td>
<td>20</td>
<td>31</td>
</tr>
<tr>
<td>Miles</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>Acres</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Square Miles</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Feet</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Inches</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>162</strong></td>
<td><strong>248</strong></td>
</tr>
</tbody>
</table>

twice as many indefinite indicators than does People. In addition, students tend to encounter proportionately more indefinite references to space (2.5 per 1,000 words) in People than they do in Quest (1.4 per 1,000). Of the eight indicators listed, only five are found in People.

Both texts had considerably fewer specific references to space than indefinite references. People, for example, had only eight specific references, but 162 indefinite references to space or over twenty times as many indefinite references as specific references. Quest had only ninety-nine specific references, but 248 indefinite references to space or over twice as many indefinite references as specific references.

Table 7, page 104, deals with the fifth of the seven categories examined, specific references to time. An examination of the table
Table 7
Category 5: Specific References to Time in Two Eighth Grade United States History Textbooks

<table>
<thead>
<tr>
<th>Quantitative concept indicators</th>
<th>Frequency We the People</th>
<th>Frequency Quest for Liberty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Years</td>
<td>41</td>
<td>150</td>
</tr>
<tr>
<td>Days</td>
<td>6</td>
<td>26</td>
</tr>
<tr>
<td>Hours</td>
<td>5</td>
<td>67</td>
</tr>
<tr>
<td>Months</td>
<td>4</td>
<td>17</td>
</tr>
<tr>
<td>Centuries</td>
<td>3</td>
<td>26</td>
</tr>
<tr>
<td>Weeks</td>
<td>2</td>
<td>14</td>
</tr>
<tr>
<td>Minutes</td>
<td>1</td>
<td>12</td>
</tr>
<tr>
<td>Age</td>
<td>0</td>
<td>40</td>
</tr>
<tr>
<td>Term (of office, etc.)</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Phases</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Decade</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Centennial</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>62</strong></td>
<td><strong>359</strong></td>
</tr>
</tbody>
</table>

reveals that *Quest* had approximately six times as many specific references to time as did *People*. Students using *Quest* would, on the average, encounter two of these references for every 1,000 words, while students using *People* would encounter one of these references for every 1,000 words. Of the twelve indicators listed, only seven are found in *People*.

Table 8, page 105, indefinite references to time, follows the same pattern as indefinite references to quantities and space. Although the number of these indicators in *Quest* (433) exceeds that of *People* (314),
Table 8  
Category 6: Indefinite References to Time in Two Eighth Grade United States History Textbooks

<table>
<thead>
<tr>
<th>Quantitative concept indicators</th>
<th>Frequency We the People</th>
<th>Frequency Quest for Liberty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time Periods Generally</td>
<td>102</td>
<td>79</td>
</tr>
<tr>
<td>Now, Later, Before, Soon, After, Today</td>
<td>42</td>
<td>101</td>
</tr>
<tr>
<td>Always, Sometimes, After</td>
<td>65</td>
<td>83</td>
</tr>
<tr>
<td>Years</td>
<td>41</td>
<td>52</td>
</tr>
<tr>
<td>Early, Early Americans</td>
<td>22</td>
<td>11</td>
</tr>
<tr>
<td>Past, Present, Future</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>Hours</td>
<td>8</td>
<td>17</td>
</tr>
<tr>
<td>Quickly, Slowly</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Days</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>Seasons</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Months</td>
<td>3</td>
<td>14</td>
</tr>
<tr>
<td>Centuries</td>
<td>2</td>
<td>15</td>
</tr>
<tr>
<td>Weeks</td>
<td>1</td>
<td>12</td>
</tr>
<tr>
<td>Gradually, Recently, Usually At Once</td>
<td>0</td>
<td>19</td>
</tr>
<tr>
<td>Never, Seldom, Frequently, Occasionally</td>
<td>2</td>
<td>15</td>
</tr>
<tr>
<td>Minutes</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Term (of office)</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>314</strong></td>
<td><strong>433</strong></td>
</tr>
</tbody>
</table>

there are proportionately more of these indicators in People. Students using Quest would tend to encounter 2.5 of these references for every
1,000 words while students using People would tend to encounter five references for every 1,000 words. Of the twelve indicators listed, only seven were found in People.

Both texts, but particularly People had considerably fewer specific references to time than indefinite references. People, for example, had only sixty-two specific references, but 314 indefinite references to time or over five times as many indefinite references as specific references. Quest had 359 specific references, but 433 indefinite references to time.

The last category of quantitative terms tabled was graphic displays. Although Quest had more of these terms (136) than did People (83), students using Quest would, on the average, encounter less than one graphic display (.76) for every 1,000 words, while students using People would encounter 1.3 displays for every 1,000 words. Of the eleven types of graphic displays listed, each book had nine. As can be seen in Table 9, page 107, People contained no charts or line graphs, while Quest contained no scales of altitude or time lines.

Results of Hypotheses Testing

For the purpose of clarity the hypotheses will be considered in groups according to analysis of covariance and according to correlations. Hypotheses numbers one, two, and three dealing with covariance analysis will be presented first followed by the correlational hypotheses four, five, and six.

Analysis of Covariance

H1: After statistically controlling for the variables of vocabulary and comprehension achievement scores, math
Table 9
Category 7: Graphic Displays in Two Eighth Grade United States History Textbooks

<table>
<thead>
<tr>
<th>Nature of graphic display</th>
<th>Frequency</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>We the People</td>
<td>Quest for Liberty</td>
</tr>
<tr>
<td>Scale of Miles</td>
<td>27</td>
<td>22</td>
</tr>
<tr>
<td>Scale of Altitude</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Population (Symbols)</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Population (Dots)</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Pictorial Graphs</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Pictorial Graphs (Maps)</td>
<td>34</td>
<td>64</td>
</tr>
<tr>
<td>Charts</td>
<td>0</td>
<td>27</td>
</tr>
<tr>
<td>Bar Graphs</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Line Graphs</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Circle Graphs</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>Time Lines</td>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>83</strong></td>
<td><strong>136</strong></td>
</tr>
</tbody>
</table>

Concept achievement scores and grade point averages, eighth grade students using a United States History textbook which has a greater number of quantitative concepts do not perform better than eighth grade students who are using a United States History textbook which has fewer quantitative concepts on a test designed to measure the extent to which students understand quantitative concepts used in their United States History textbooks.

H₂: After statistically controlling for the variables of
vocabulary and comprehension achievement scores, math achievement scores, and grade point averages, eighth grade students using a textbook with many quantitative terms and a textbook with fewer quantitative terms do not perform better than eighth grade students who are using only one of the textbooks, on a test designed to measure the extent to which students understand quantitative concepts used in their United States History textbooks.

H₃: There is no difference between the scores of eighth grade boys and the scores of eighth grade girls on a test designed to measure the extent to which students understand quantitative concepts used in their United States History textbooks.

The hypotheses were tested by using the scores of 263 students who were given a test on Quantitative Concepts. The analyses of covariance is summarized in Table 10, page 109.

Table 10 reveals that the adjusted means for the texts used were very close together. The mean for People was 63.13 and for Quest was 63.27. The mean for students using both texts was 64.95. The critical value for rejection of the null hypotheses at the .05 level of significance is a value greater than or equal to 3.04 for two degrees of freedom. Since the value calculated is 0.58, differences between the scores of students using People, students using Quest, and students using both texts are nonsignificant.

However, the table does reveal that the mean scores of boys are higher than those of girls. Since the F value calculated is 5.67, the difference in the achievement scores between boys and girls is significant (F = 3.89, p<.05). The overall mean for boys was 65.49 and for girls
Analyses of Covariance of Text and Sex Differences with Test on Quantitative Concepts as Dependent Variable with Table of Means

<table>
<thead>
<tr>
<th>Source</th>
<th>Degree of freedom</th>
<th>Sum of squares</th>
<th>Mean square</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Text</td>
<td>2</td>
<td>157.36</td>
<td>78.68</td>
<td>.58</td>
</tr>
<tr>
<td>Sex</td>
<td>1</td>
<td>770.58</td>
<td>770.58</td>
<td>5.67*</td>
</tr>
<tr>
<td>Text Sex</td>
<td>2</td>
<td>114.32</td>
<td>57.16</td>
<td>.42</td>
</tr>
<tr>
<td>Covariates</td>
<td>4</td>
<td>21,304.67</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Error</td>
<td>253</td>
<td>34,412.48</td>
<td>13.02</td>
<td></td>
</tr>
<tr>
<td>Totals</td>
<td>262</td>
<td>56,759.41</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p < 0.05

Adjusted Means

<table>
<thead>
<tr>
<th>Text</th>
<th>People</th>
<th>Quest</th>
<th>Both</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>S=15.07</td>
<td>S=19.71</td>
<td>S=18.24</td>
<td>62.08</td>
</tr>
<tr>
<td>X F</td>
<td>61.79</td>
<td>60.65</td>
<td>63.80</td>
<td>64.95</td>
</tr>
<tr>
<td>Total</td>
<td>63.13</td>
<td>63.27</td>
<td>64.95</td>
<td></td>
</tr>
</tbody>
</table>

was 62.08. Regardless of the text used, boys outscored girls. For students who used People, the boys mean was 64.48 while the mean for girls was 61.79. Boys using Quest had a mean of 65.90 while girls using the same text had a mean of 60.65. When classes used both texts, boys scored 66.10 while girls scored 63.80.

The scores given for the adjusted Means in Table 10 are given in
percentages. The maximum possible raw score was thirty-five. Since the percentage of correct responses ranged from 60.65 (girls using Quest) to 66.10 (boys using both texts), the mean range of correct student responses was from twenty-one to twenty-three. The students with the highest scores, therefore, still responded correctly to less than two-thirds of the test items.

**Correlational Analysis**

$H_4$: There is no positive correlation between reading achievement and the understanding of quantitative concepts.

$H_5$: There is no positive correlation between mathematical achievement and the understanding of quantitative concepts.

$H_6$: There is no positive correlation between perceived teacher activity and the understanding of quantitative concepts.

To test these hypotheses the Pearson Product-Moment Correlation Coefficient was computed. The correlation data is summarized in Table 11, page 111.

All correlations between the Test on Quantitative Concepts, comprehension, vocabulary, and math concepts were highly significant. However, no significant relationship exists between perceived teacher activity and any quantitative test variable. Therefore, hypotheses four and five are rejected and hypotheses six is accepted.

In general, the magnitude of the relationship that exists between variables may be interpreted as follows:

- $r=±.00$ to $±.20$, negligible relationship
- $r=±.20$ to $±.40$, low relationship
- $r=±.40$ to $±.70$, marked relationship
\[ r = \pm .70 \text{ to } \pm 1.00, \text{ high to very high relationship.}\] 

Table 11

<table>
<thead>
<tr>
<th></th>
<th>Comprehension</th>
<th>Vocabulary</th>
<th>Math Concepts</th>
<th>Perceived Teacher Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Test on Quantitative Concepts</strong></td>
<td>.6814*</td>
<td>.6834*</td>
<td>.6796*</td>
<td>.0369</td>
</tr>
<tr>
<td><strong>Definite Concepts</strong></td>
<td>.5619*</td>
<td>.5904*</td>
<td>.5979*</td>
<td>.0539</td>
</tr>
<tr>
<td><strong>Indefinite Concepts</strong></td>
<td>.6329*</td>
<td>.6277*</td>
<td>.5811*</td>
<td>.0238</td>
</tr>
<tr>
<td><strong>SUBTESTS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Specific Quantities</td>
<td>.5093*</td>
<td>.5655*</td>
<td>.5713*</td>
<td>.0170</td>
</tr>
<tr>
<td>Indefinite Quantities</td>
<td>.4446*</td>
<td>.4299*</td>
<td>.4398*</td>
<td>.0053</td>
</tr>
<tr>
<td>Specific Space</td>
<td>.2880*</td>
<td>.2955*</td>
<td>.3493*</td>
<td>.0528</td>
</tr>
<tr>
<td>Indefinite Space</td>
<td>.3882*</td>
<td>.4150*</td>
<td>.3738*</td>
<td>.0380</td>
</tr>
<tr>
<td>Specific Time</td>
<td>.3787*</td>
<td>.3795*</td>
<td>.3407*</td>
<td>.0621</td>
</tr>
<tr>
<td>Indefinite Time</td>
<td>.6242*</td>
<td>.6089*</td>
<td>.5309*</td>
<td>.0895</td>
</tr>
<tr>
<td>Graphs</td>
<td>.5571*</td>
<td>.5281*</td>
<td>.5605*</td>
<td>.0135</td>
</tr>
</tbody>
</table>

*p < .05

Table 11 reveals a marked relationship between the scores on the Test on Quantitative Concepts (TQC) and the students' reading comprehension, vocabulary and math concepts with each of these correlations being almost identical at .68. However, there is no relationship between TQC and Perceived Teacher Activity.

The TQC test was divided into approximately the same number of definite concepts and indefinite concepts. Table 11 reveals that the correlation between Indefinite Concepts and Reading and Vocabulary was the highest, .6329 and .6277 respectively. Almost as high were the correlations between definite concepts and vocabulary (.5904) and math (.5979). Thus, the students who tend to be good readers and to have an adequate grasp of math concepts tend to also understand the quantitative terms expressed in their social studies texts. Students also tend to understand indefinite quantitative concepts better than definite ones.

The subtests in Table 11 indicate varying degrees of correlation with all concepts having a moderate correlation with comprehension, vocabulary, and math. Since there were six or less items for every subtest (excluding the graphic displays subtest), these lower correlations were expected; however, the fact that even these subtests are significant indicates that there is good internal consistency in the Test on Quantitative Concepts.

SUMMARY

Six hypotheses were tested. Hypotheses one and two were accepted. There were no significant differences among students using either or both of two United States History textbooks in their understanding of the quantitative concepts contained in their textbooks.
Hypothesis three was rejected. Boys perform significantly better on a test designed to measure their understanding of the quantitative concepts contained in their United States History textbooks.

Hypotheses four and five were rejected. There is a significant positive correlation between reading achievement and the understanding of quantitative concepts and between math achievement and the understanding of quantitative concepts.

Hypothesis six was accepted. There was no correlation between perceived teacher activity and the understanding of quantitative concepts.

The conclusions that can be drawn from these hypotheses will be discussed in the next chapter.
Chapter 5

SUMMARY, CONCLUSIONS, AND IMPLICATIONS

The major purpose of this study was to (a) analyze the nature and frequency of quantitative concepts encountered in two eighth grade United States History textbooks; and (b) analyze pupils' understanding of quantitative concepts in relationship to the textbooks used, their reading achievement, math achievement, sex, and perceived teacher activity.

A review of related literature and expert opinion was conducted relative to the readability and selection of social studies textbooks, students' understanding of the ideas presented in social studies textbooks, the development of concepts in children's understanding of quantitative concepts, including time and space concepts, and student evaluation of teaching performance. The purpose of the review was to ascertain the types of concepts presented to students in social studies textbooks and the extent of students' understanding of some of these concepts.

Studies reviewed suggested that elementary school students have considerable difficulty in comprehending the quantitative terms and concepts in their social studies textbooks. Therefore, the present

1Friedman, "Time Concepts"; see also Gabel, "Retention of Social Studies Materials"; see also Waido, "Quantitative Expressions."
study attempted to analyze the extent to which these same types of concepts were presented in eighth grade social studies textbooks and to test eighth grade students' understanding of these terms and concepts.

The sample consisted of 263 pupils in twelve classes and was drawn from five schools in three adjacent school districts. The racial composition of the schools involved ranged from 75 to 83 percent Caucasian, from 4 to 14 percent Black, and from 4 to 11 percent Spanish surname.

The testing instrument used in the study to measure the students' reading comprehension, vocabulary, and math concepts was the Comprehensive Test of Basic Skills (CTBS), Form Q, Level 4. In addition a content analysis of the two textbooks used by the students was made in order to analyze the types and quantity of quantitative concepts expressed in the books. Based on this analysis the investigator constructed the Test on Quantitative Concepts (TQC) to determine student knowledge of these concepts. Part II of the Test on Quantitative Concepts consisted of an instrument designed to measure the extent to which students feel their teachers were teaching them quantitative concepts.

Textbook Analysis

The textbooks chosen for the study were Quest for Liberty and We the People, both of which were eighth grade United States History textbooks which had been adopted by the State of California for use in its public schools. Results of the examination of the textbooks indicated that Quest for Liberty had about three times as many words as did We the People. Although Quest had a much greater number of quantitative references than did People, students using People would tend to encounter
proportionately more of the terms in most categories than would students using Quest. An analysis of the tables indicates that Quest students encounter proportionately, as well as numerically, more references dealing with specific quantities and specific time, while People students encounter proportionately but not numerically more references dealing with specific space, indefinite space, indefinite time, and indefinite quantities. In addition, a comparison of the tables shows that both textbooks carry many more indefinite references than specific references. People had almost eight times as many indefinite references to quantities as it had specific references. Quest had more than twice as many indefinite references as it had specific references. Tables 5 and 6 indicate that People had over twenty times as many indefinite references to space as it had specific references, while Quest had more than twice as many indefinite references. Likewise, indefinite references to time in People exceed specific references five to one, while indefinite references to time in Quest only slightly exceeded specific references to time.

A further examination of Tables 3 through 8 reveals that in both textbooks the most frequently occurring reference, both specific and definite, are in order: reference to quantities, references to time, and references to space.

The results of this analysis disagree with Arnsdorf's findings that space terms were used in textbooks more frequently than time terms. This present study found just the opposite. However, the study supported Arnsdorf's other finding that indefinite time and space terms greatly

\[2\] Arnsdorf, "Time and Space Terms."
outnumber definite time and space terms.

Student Understanding of Quantitative Concepts

By use of the analysis of covariance to adjust for differences in grade point averages, reading, vocabulary, and math scores, classes using either or both of the textbooks were compared in their understanding of quantitative concepts. No significant differences were found among the scores of students using People, students using Quest, and students using both texts.

These findings appear to support the conclusion of Howards that mere frequency of occurrence does not guarantee familiarity or understanding on the part of the reader. Regardless of whether a student used a textbook with many quantitative terms, or a textbook with relatively few quantitative terms, or both textbooks, his understanding of the quantitative terms in the textbooks was not affected.

As was shown in Table 10, the mean for students using both texts was 64.95. Thus, the average student was able to answer correctly somewhat less than two-thirds of the test items. This result can be contrasted with Waldo's finding which indicated that at the fifth grade level, the average student marked correctly only 54.3 percent of the test items. A further comparison can be made with the results of Jensen's study which indicated that at grade four students understood about 30 percent of quantitative expressions and at grade six they understood about 50 percent of these expressions. Table 12, below, is an illustration of how student growth

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in understanding quantitative concepts improves as pupils advance in grade level. The table incorporates the findings of the present study as well as those of Waldo and Jensen.

Table 12

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percent of correct responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 (Jensen)</td>
<td>30.0%</td>
</tr>
<tr>
<td>5 (Waldo)</td>
<td>54.3%</td>
</tr>
<tr>
<td>6 (Jensen)</td>
<td>50.0%</td>
</tr>
<tr>
<td>8 (Bush)</td>
<td>64.9%</td>
</tr>
</tbody>
</table>

Although the profile shown above is based on three different tests, a trend is shown that as students progress through the higher grades, their understanding of quantitative concepts improves. Yet, even by grade eight students continue to have considerable difficulty with these concepts. The trend shown in Table 12 is consistent with the finding of Oakden and Sturt, Pistor and Friedman, all of whom found that maturation was an important element in the understanding of quantitative concepts.\(^6\),\(^7\),\(^8\) The increased understanding of students as they progress from the lower grades to the upper grades is also consistent with Piaget's

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\(^6\) Oakden and Sturt, "The Development of Knowledge."

\(^7\) Pistor, "Time Concepts of Children."

\(^8\) Friedman, "Time Concepts."
theory of intellectual development. In grade eight, students have left the stage of concrete operations (seven to eleven years) and moved to the stage of formal operations (eleven to fifteen years). Prior to this stage students were developing the ability to apply logical thoughts to concrete problems. By the time they have reached the eighth grade, however, they are learning to apply logic to all classes of problems including the abstract. Thus, their cognitive structure in grade eight is at a greater level than it was in the lower grades, and their ability to better comprehend the abstract quantitative concepts in their textbooks is greater also.

However, the present study contradicts the findings of Friedman and Jensen in one important aspect. Whereas both investigators found no differences according to sex for students in grades four and six, the present study shows that at the eighth grade level, boys had significantly better test scores than did girls. The reason for this difference in Friedman's study may be that Friedman was concerned only with time concepts, while the present study also measured numerical and space concepts. However, Jensen's study involved time, space, and numerical concepts. Dobbs, on the other hand, found that although boys demonstrated an ability to estimate intervals about time more accurately than did girls, girls had a more extensive vocabulary of time words than did boys. Another reason for this difference may be that sometime between grades six and eight, boys encounter more of the concrete

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10 Idem.

11 Jensen, "Quantitative Concepts."

12 Dobbs, "Time Sense and Chronology."
experiences referred to by Piaget and Rogers. 13

Relationships Between Quantitative Understandings and Other Factors

In addition to an analysis of covariance, correlations were made between the understanding of quantitative concepts and reading achievement, the understanding of quantitative concepts, and math achievement, and the understanding of quantitative concepts and perceived teacher activity (PTA) in teaching quantitative concepts. The results indicated that there were marked relationships between math and reading ability and the understanding of quantitative concepts. This finding supported the results of Muscio's study which also found a high correlation between quantitative understanding and math and quantitative understanding and reading in grade six. This finding is also consistent with other data which indicates that in grades five through eight there is a high correlation between math and reading, and in grade eleven, social studies abilities are highly correlated with reading. 14, 15 The results of the present study confirm the findings of Fay who concluded that general reading and the ability to read maps, charts, globes, and tables are highly correlated. 16 However, the present study does not support Fay's conclusion that there is no correlation between math and reading. The present study found a correlation of .68 between quantitative understanding and math.

13Duckworth, "Piaget Rediscovered"; see also Rogers, "Facts to Concepts."
14Coffing, "Arithmetical Ability."
15Artley, "Reading Comprehension."
16Fay, "Sixth Grade Achievement."
Another result of the present study is that the correlations between reading and math achievement and the understanding of indefinite quantitative concepts is approximately the same as between reading and math achievement and the understanding of definite quantitative concepts. Gabel, however, found that students in all grade levels, six through twelve, understand definite quantitative concepts better than they did indefinite quantitative concepts.17

Another question that the present study attempted to answer is whether there is a relationship between the understanding of quantitative concepts and the perceived teacher activity in teaching these concepts. The literature has indicated that student evaluation of teacher performance is not only very helpful to teachers, but that it is becoming more and more of a reality.18,19 That this concept is valid at the junior high school was shown by the data collected by Somers and Southern which indicated that students' assessment of the qualities of a good teacher were highly correlated with the same assessment by the teachers themselves.20 The present study found that there was an almost zero correlation between Perceived Teacher Activity and all measures of quantitative concept understanding. That is, what students may think their teachers are teaching about these concepts has no relationship to the students own understanding of these concepts.

The present study confirmed the findings of previous

17 Gabel, "Social Studies Materials."
18 Rodin, "Rating the Teachers."
19 Bendig, "Student Achievement."
20 Somers and Southern, "A Rating Scale."
investigations that students are faced with a tremendous number of quantitative concepts in their social studies textbooks.\textsuperscript{21,22} Although there has been a cry from researchers for years for a more controlled vocabulary and for definition of terms in social studies, these cries have been either ignored or unheeded by those who publish textbooks. The burden then, falls on the classroom teacher, who must first recognize that students have a great amount of difficulty in understanding the quantitative concepts expressed in social studies materials. The present study indicates that eighth graders understand only approximately two-thirds of these concepts. Once this fact is accepted, teachers must make conscious efforts to devise strategies to teach these concepts. One such strategy would be to give students the opportunity to engage in activities that will provide them actual experiences with numbers in the social setting.

Piaget has stated that concept formation in children is tied to certain stages of growth, one of which is concrete operations, which generally happens between the time a child is seven and eleven years old. The major implications of the study is that children, girls perhaps more so than boys, have not had the opportunity to apply logical thought to concrete problems involving quantitative terms. As a result, they have a very difficult struggle with formalizing concepts dealing with time, space, and quantities reflected in their social studies materials. Other writers such as Reynolds, Rogers, and Spadek, have also emphasized the

\textsuperscript{21}Waldo, "Quantitative Expressions."
\textsuperscript{22}Jensen, "Quantitative Concepts."
need for concrete experiences before abstractions are possible.  

In the interpretation of data and in drawing conclusions, certain limitations of the investigation should be remembered. These limitations are as follows: (1) The study was limited to a sample of eighth grade students from three suburban Solano County communities representing a predominately middle socioeconomic status population; (2) Only two eighth grade history textbooks were used in the study. Extra materials that teachers may have brought in to supplement the textbooks were not considered; (3) The content analysis instrument was designed by the investigator. Other investigators using different criteria could obtain results dissimilar to the results of this present study; (4) The conclusions of this study are limited to the eighth grade level. No attempt should be made to extend the results beyond this level.

CONCLUSIONS

The findings of this investigator, subject to the limitations previously cited, support the following conclusions.

1. Eighth grade students are subjected in their textbooks to large numbers of concepts relating to time, space, and quantity.

2. Most of the quantitative concepts encountered in social studies textbooks are of an indefinite nature rather than of a specific nature.

3. Eighth grade students who use a textbook with more quantitative terms fail to understand those terms any better than do students using a textbook with fewer of these terms.

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23 Reynolds, Rogers, Spadek.
4. Eighth grade students who use two textbooks, one with a greater number of quantitative terms and one with fewer of these terms, fail to understand these terms any better than do students who use any one of these textbooks.

5. The average eighth grade student tends to understand less than two-thirds of these quantitative concepts in these textbooks.

6. Generally, boys understand these concepts better than do girls.

7. Eighth grade students who perform well in math and in reading understand the quantitative terms in their social studies textbooks better than students who do poorly in these areas.

8. There is no relationship between students' understanding of quantitative concepts and the extent to which they feel their teachers are teaching these concepts.

RECOMMENDATIONS FOR FURTHER RESEARCH

Based on the findings of this study, several recommendations can be made. First, an experimental study should be conducted involving students from various grade levels who are taught quantitative concepts through the use of manipulative material. These children's test scores should be compared to a second group who were taught these concepts through the usual lecture-discussion approach. Both of these groups' scores would then be contrasted with a control group, where no special emphasis was placed on the teaching of these concepts. This study would test Piaget's theory of the importance of concrete operations in the development of logical thought.

Second, an experiment might be designed where the type of
quantitative concepts encountered in social studies textbooks are taught in a math class and integrated with a social studies course. Students' scores could then be measured in their social studies class through means of a pre- and posttest to determine the amount of carry-over of the concepts. These scores could then be contrasted with a control group. This experiment would study further the positive correlation between math achievement and the understanding of quantitative concepts.

Third, a longitudinal study might be designed where a particular class, for example, a fifth grade or eighth grade class, is followed through a school system for two or more years in order to study the growth of their understanding of these concepts as they mature. This study might be combined with one of the two previously listed, and would provide a study of the same children, whereas studies up to this point have involved different populations and different research techniques.

A fourth study that might be designed is to share with a group of teachers in one or more schools the results of this study. Their students would be given a pretest similar to the Test on Quantitative Concepts, and the teachers would be told that a similar test would be given at the end of the year. Teacher emphasis on math would be appraised through observation during the semester and the teachers dichotomized in terms of heavy emphasis versus little emphasis. This study would seek to determine the effect on student understanding of quantitative concepts once teachers are aware that these concepts are to be incorporated in their course of study.
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APPENDIX A

TEST ON QUANTITATIVE CONCEPTS
TEST ON QUANTITATIVE CONCEPTS

To The Student:

You are about to take a test on your knowledge of some of the concepts mentioned in your social studies textbooks. These concepts include references to: quantities of objects, time, and space.

Part I of the test contains thirty-five items. For each item there is a statement followed by five choices, one of which completes the statement or question. You are to select the best answer from the list of five choices. Fill in the number for the best choice on your answer sheet.

Example:

1. "President Lincoln did not live to carry out his plans to help the South and the Negro after the Civil War. He was assassinated on April 14, 1865, five days after the South had surrendered."

This means that the South surrendered on what date?

(A) April 7
(B) April 8
(C) April 9
(D) April 10
(E) April 11

The correct answer is April 9 so (C) is the best choice. You would fill in blank C for item 1 on your answer sheet.

A. B. C. D. E.
   " " " " "
   " " " " "
   " " " " "
   " " " " "
   1. " " " " "

Remember: You are to select the best choice for each item.

WHEN YOU ARE GIVEN PERMISSION, YOU MAY TURN THE PAGE AND BEGIN THE TEST.

YOU MAY TAKE THE ENTIRE CLASS PERIOD FOR THE TEST.

DO NOT WRITE IN THIS BOOKLET
1. By the early 1960's American space projects were succeeding. In 1961 Project Mercury sent Alan Shepard on a **15 minute** space flight.

   Shepard's flight might have lasted:
   
   (A) half a day  
   (B) about an hour  
   (C) a few minutes  
   (D) a whole day  
   (E) a few seconds

2. When the colonists first arrived in the New World, many of them fell upon their knees and blessed the God of heaven who had brought them over the **vast** ocean safely.

   Vast means:
   
   (A) dangerous  
   (B) enormous  
   (C) rough  
   (D) unknown  
   (E) deep

3. In 1735, trustees of the colony of Georgia gave to each person who would help build a new town a watch, a musket, a shovel or a spade... and **9 ounces** of spice.

   Based on the above statement, how much spice might a man get for helping build a new town?
   
   (A) about a pound  
   (B) less than a pound  
   (C) slightly more than a pound  
   (D) about five pounds  
   (E) about two pounds

4. Most Americans in the 1960's lived in more comfort than at any other time in our history. **Billions of dollars** were spent for entertainment such as sports, travel, and movies.

   How much money was spent on entertainment?
   
   (A) a little more than a million dollars  
   (B) less than a million dollars  
   (C) about a hundred million dollars  
   (D) about a billion dollars  
   (E) several billion dollars
5. In New York City, which had the worst slums at the turn of the century, the typical tenement was five or six stories in height.

A one story building is about how high?

(A) as tall as a six foot man
(B) about ten to fifteen feet high
(C) the same height as a telephone pole
(D) one hundred feet high
(E) a thousand feet high

6. Colonization followed exploration. Thousands of people came to the New World. Spanish, French, and English colonies became established in many parts of North America.

Thousands of people means:

(A) there were about a thousand people
(B) someone guessed there were about a thousand people
(C) there were less than two thousand people
(D) there were many people and the exact number is not known
(E) there were probably less than a thousand people

7. Although the farmer dispossessed the rancher, he still had many problems. The farmer had to get an adequate water supply for his crops but the rainfall was usually only about fifteen inches a year.

The annual rainfall was usually:

(A) about a foot
(B) about half a foot
(C) a little over a foot
(D) about two feet
(E) about a yard

8. The Cherokees were forced by United States soldiers to follow "the trail of tears." More than 5,000 of the 13,000 Cherokees died of disease and hunger during the trip. The Indians had to leave their homes and land behind.

Based on the above, which of the following statements is true?

(A) all of the Indians died
(B) more than half the Indians died
(C) most of the Indians died
(D) a small portion of the Indians died
(E) less than half the Indians died
9. A patent is a government document protecting an inventor for a number of years. A patent gives the inventor alone the right to make and sell his invention.

A patent protects an inventor:

(A) for a time specified by law
(B) for five years
(C) for ten years
(D) until the inventor is 65
(E) until a new president is elected

10. The pioneers faced many hardships on the frontier. Most families lived alone on farms far from settlements.

Based on the above, which of the following statements is true?

(A) most pioneer families lived close to other families
(B) pioneer families built their own little towns far away from other towns
(C) most pioneer families did not live close to towns
(D) most pioneer families lived within a few blocks of settlements
(E) pioneer families lived close to towns

11. In the latter part of the nineteenth century, America became a great industrial and urban society.

This would include the time period from:

(A) 1800-1900
(B) 1850-1900
(C) 1800-1850
(D) 1900-1950
(E) 1900-present

12. The most famous road in 1811 was the Cumberland Road, which was more than 500 miles long when completed.

This represents the approximate distance from:

(A) Sacramento to San Francisco
(B) Sacramento to Lake Tahoe
(C) Sacramento to San Jose
(D) Sacramento to New York City
(E) Sacramento to Los Angeles
13. Unemployment rose alarmingly from four million in 1930 to an estimated thirteen million in 1932. In many cities one out of every four workers were employed.

In a city the size of Vacaville there are about 16,000 workers. How many of these would have been unemployed in 1932?

(A) 160
(B) one thousand
(C) sixteen thousand
(D) four
(E) four thousand

14. The cattle boom started in the 1860's when Texans found that a steer worth about four dollars in Texas might be worth about forty dollars in Chicago.

How much greater was the value of the steer by the time it had reached Chicago?

(A) $40 more valuable
(B) twice as valuable
(C) $160 more valuable
(D) ten times as valuable
(E) $10 more valuable

15. In the 1800's farmers soon learned that large farms were successful on the Plains. With machinery a farmer could plant and harvest thousand of acres of wheat.

Thousands of acres of wheat might be equivalent in size to:

(A) one hundred handball courts
(B) one hundred basketball courts
(C) an area the size of any one of our national forests
(D) one hundred tennis courts
(E) an eighteen hole golf course

16. As industries grew during the Industrial Revolution, more workers were needed. Because these workers needed to earn a living, they would work long hours for low wages.

The term **long hours** means:

(see next page)
(A) the number of hours a person worked was more than eight hours a day
(B) the number of hours was less than eight, but the work was very boring
(C) eight hours a day
(D) the number of minutes in an hour was more than it is now
(E) working an eight hour shift, which begins in the evening and finishes about dawn

17. The shareowner's political and economic power helped to shape the southern culture and way of life. In late colonial South Carolina, one fifth of the plantation owners had four fifths of the wealth.

Based on the above, which one of the following statements is true?

(A) most plantation owners were very wealthy
(B) about half of the plantation owners had about half of the wealth
(C) a few of the plantation owners had most of the wealth
(D) more than half of the plantation owners had most of the wealth
(E) the wealth was distributed fairly evenly among most of the plantation owners

18. When Marco Polo returned to Europe from the East, he told many stories about what he had seen. Europeans knew that it would be difficult for them to trade with the East. The East was thousands of miles away, across deserts and mountains.

The distance from Europe to the East was probably:

(A) 5,000 miles
(B) 20,000 miles
(C) 30,000 miles
(D) 40,000 miles
(E) 50,000 miles

19. On April 12, 1861, the South attacked Fort Sumter, a United States fort in South Carolina. Two days later the commander of the fort surrendered. The South's attack on Fort Sumter started a war between the North and the South.

The date of the surrender of Fort Sumter was:

(see next Page)
20. The cost of land on the frontier was low. A pioneer could buy 80 acres of good land for $100.

This means that for $100 a pioneer could buy an area of land about the size of:

(A) 80 tennis courts  
(B) 80 golf courses  
(C) 80 basketball courts  
(D) 80 football fields  
(E) 80 handball courts

21. At first each farm produced only enough for the owner and his family. In time the farm began to produce more than the farmers could use. Farmers found that they could earn money by selling their surplus products.

Surplus products means:

(A) that the farmers needed more products  
(B) that the farmers had just about enough  
(C) that there were enough for most of the people  
(D) that the farmers had more than they needed for their own use  
(E) that there was a shortage of products

22. Indentured servants were brought to Virginia from Europe and Africa. Their voyage to the new world was paid for by the land owner. In return, they worked for the land owner for a certain number of years.

This means that an indentured servant had to work:

(A) for five years  
(B) for ten years  
(C) for fifteen years  
(D) the exact number of years is hard to say  
(E) until he had reached to age of 21

23. Immigrant groups met with initial hostility, though the reasons and the results differed. Some American citizens still face some form of discrimination.

According to these statements, which of the following is true?

(see next page)
(A) most Americans are discriminated against
(B) a certain number of Americans are discriminated against
(C) a very few Americans are discriminated against
(D) about a thousand Americans are discriminated against
(E) at least a couple of hundred Americans are discriminated against

24. When the United States was born in 1789, it was a country Americans today would not recognize, a sparsely settled nation of farmers. Yet the basic rules of government for our nation were established during that period of our history.

"Sparsely settled nation of farmers" means:

(A) there were many farmers who lived close together
(B) there were many farmers who lived far apart from each other
(C) there were hardly any farmers at that time
(D) each home had its own little tobacco farm
(E) farmers raised mostly green vegetables

25. For centuries, religious and royal courts and government officials often used torture to obtain a confession from an accused man. To stop their torture, innocent people often confessed.

This means that torture was used to obtain confessions:

(A) for hundreds of years
(B) for a hundred years
(C) for about a hundred years
(D) after a series of wars
(E) during World War II, and the Vietnam War

26. Americans traveled to Oregon by way of the Oregon Trail in wagon trains. A wagon train could travel only about ten miles a day.

Ten miles is the approximate distance from:

(A) Fairfield to Travis Air Force Base
(B) Vacaville to Sacramento
(C) Fairfield to Vacaville
(D) Fairfield to Davis
(E) Vacaville to Vallejo

27. The American Revolution was the first of many revolutions in which new nations have freed themselves from colonial rule. Most of these revolutions in the last thirty years or so have occurred in Asia and Africa.

(see next page)
This means that most of these recent revolutions have occurred:

(A) since you were born
(B) before 1900
(C) around 1776
(D) before your parents' lifetime
(E) during your parents' lifetime

28. In 1841 there were only about five hundred Americans in the whole Oregon Country. In 1843, however, Americans started to get "Oregon fever".

Another way of looking at the number of Americans in the Oregon Country in 1841 is to say there were:

(A) numerous Americans in the Oregon Country in 1841
(B) about a thousand Americans in the Oregon Country in 1841
(C) a few Americans in the Oregon Country in 1841
(D) a few hundred Americans in the Oregon Country in 1841
(E) no Americans in the Oregon Country in 1841
USE OF LAND AND RESOURCES IN COLONIAL AMERICA

- Cattle and grain
- Tobacco
- Rice and indigo
- Fishing
- Whaling
- Lumber
- Shipbuilding
- Furs and skins
- Ironworks
- Trading and shipping centers

Source: We the People
D. C. Heath and Company
c. 1970 Page 30
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Note: Use the map above to answer the next two questions.

29. A town such as Newport or New London which was engaged in shipbuilding usually had an ironworks nearby. How far is the ironworks from Newport? (see next page)
30. Which towns were involved in the growing of rice:

(A) Norfolk and Fort Augusta
(B) Philadelphia and Baltimore
(C) Charleston and Savannah
(D) Portsmouth and Boston
(E) Charleston and New Bern

Note: Use the chart above to answer the following three questions.

31. According to the chart, in what year was the percentage of the urban population closest to that of the rural population?

(A) 1790
(B) 1850
(C) 1900
(D) 1975

32. What is the estimated percentage of the population who will be living in urban areas in 1975?

(see next page)
33. One conclusion that can be drawn is:

(A) the population has been shifting from rural to urban
(B) the rural population is starting to increase
(C) the population has been shifting from urban to rural
(D) since 1850 the rural population has about equaled the urban population
(E) the percentage of rural and urban population has consistently remained equal

FAMILY INCOME IN THE UNITED STATES
1967

Source: We the People
D. C. Heath and Company
c. 1970 page 372
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Note: Use the graph above to answer the next two questions on the following page.
34. In 1967, what percentage of the people had an income under $3,000?

(A) 12.0%
(B) 22.3%
(C) 24.3%
(D) 16.1%
(E) 12.5%

35. In 1967, the group with the most people in it was the family income group whose income was:

(A) under $3,000
(B) $3,000 to $4,999
(C) $5,000 to $6,999
(D) $7,000 to $9,999
(E) $10,000 to $14,999
PART II

The statements below describe some activities that students sometimes engage in while taking a social studies course. If the statement applies to an activity that you engaged in while enrolled in your U. S. History class this semester, please place a check (✓) in the appropriate column.

<table>
<thead>
<tr>
<th></th>
<th>Often</th>
<th>Sometimes</th>
<th>Never</th>
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</thead>
<tbody>
<tr>
<td>1. We measured distances.</td>
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<tr>
<td>2. We weighed things.</td>
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<td></td>
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<tr>
<td>3. We compared distances mentioned in the book with distances by discussing them in class.</td>
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<tr>
<td>4. We compared weights of things mentioned in the book with other weights by discussing them in class.</td>
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<tr>
<td>5. We compared heights of things mentioned in the book with other heights by discussing them in class.</td>
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<tr>
<td>6. We discussed how long certain time periods are, which were mentioned in the book; for example, centuries, years, months, weeks, days.</td>
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<tr>
<td>7. We compared amounts of things such as money and numbers, which were mentioned in the text with other amounts of things.</td>
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<td>8. We made time lines and/or discussed the meaning of them.</td>
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<td>9. We practiced using the Scale of Miles on a map.</td>
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<tr>
<td>10. We read and discussed in class charts which were in the text.</td>
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<tr>
<td>11. We read and discussed in class the following types of graphs which were in the text:</td>
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<tr>
<td></td>
<td>(a) picture graphs</td>
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<td>(b) circle graphs</td>
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<td></td>
<td>(c) bar graphs</td>
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