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CONCEPTUAL CLARIFICATION OF CERTAIN GEOGRAPHIC TERMS

THROUGH THE USE OF FIVE PRESENTATION MODES

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[illegible]

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CHAPTER I

INTRODUCTION

A Review of the Literature

Concept development in human thinking has been a kind of Lorelei for psychologist, educator, scientist, mathematician, and linguist. Few areas have been as thoroughly explored and reported, yet with each problem that is subjected to the probe of the researcher, multiple problems spring into being.

Studies of concepts have been reported since the turn of the century with the pervasive implication that concepts constitute an important part of man's thought processes. Educational interest in concepts has been developing slowly since around 1904, and in recent years attempts have been made to delineate the nature of a concept and its actual relationship to behavior.[1]

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[1]Asahel D. Woodruff, "The Use of Concepts in Teaching and Learning," The Journal of Teacher Education, Vol. XV (1964), p. 81.

Experimental studies of concept formation have shown an astounding increase in the past few years. Most of these studies have utilized the differentiation technique (a technique in which subjects are shown a series of symbols or picture and are asked to categorize them). Woodruff, however, suggests that this is a relatively low level of conceptual activity compared with curriculum content.[1]

Currently, an increasing number of educators and psychologists are finding that they share mutual concerns in their efforts to trace and facilitate concept development. Although the educator traditionally has been primarily concerned with the role of the teacher in influencing the thinking of his student, while the psychologist has been preoccupied with the reaction of each individual, this line of demarcation appears to be fading. There are now those psychologists who choose to observe in the classroom as well as in the darkroom, and there are those educators who are seeking implications from psychological as well as from empirical findings to help them bridge the gap for their students from learning to thinking.

Many of the more recent experimental studies deal with variables which function at the higher conceptual level necessary for successful school experience. For the most part, experimentation has not been done in the school setting,

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[1]Asahel D. Woodruff, "The Use of Concepts in Teaching and Learning," op. cit., p. 93.

but there seemingly is little to preclude the possibility of the application of many experimental outcomes to the classroom situation at all levels.

If a student knows in advance what he is to look for, he is able to absorb instruction and to form concepts with greater clarity and ease, according to Fitts and Switzer.[1] Harris and Haber suggest that learning is facilitated by arranging the referent so that it is easily recognizable in the learning material; arranged so that attention is directed toward relevant stimuli and away from irrelevant ones.[2]

Wells studied the effect that training has on the ability of students to see more intricate, less obvious relationships as opposed to simple, conjunctive concepts.[3] He concluded that once students have been given this training, they tend to see disjunctive concepts regularly; they only need to discover the possibility of ferreting out such relationships.

The long revered idea that meaningful materials are learned more quickly and retained longer is subjected to

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[1] Paul M. Fitts and Gail Switzer, "Cognitive Aspects of Information Processing: I. The Familiarity of S-R Sets and Subsets," Journal of Experimental Psychology, Vol. LXIII (1962), pp. 321-329.

[2] Charles S. Harris and Ralph N. Haber, "Selective Attention and Coding in Visual Perception," Journal of Experimental Psychology, Vol. LXV (1963), pp. 328-333.

[3] Herbert Wells, "Effects of Transfer and Problem Structure in Disjunctive Concept Formation," Journal of Experimental Psychology, Vol. LXV (1963), pp. 63-69.

reappraisal by Kersh.[1] Although students comprehend more in a shorter time when certain relationships are furnished by the teacher, this research indicates that the presence of meaning has little to do with improving retention or with later use of original material. This is an unorthodox position, however, and is far from conclusive.

More in accord with expectation is the Harrow and Buchwald study which indicates that if the learner alters relationships within an old and familiar conceptual structure he experiences far less difficulty than if he is expected to utilize an entirely new conceptual structure.[2] A person perceives what he has learned to perceive and expects to perceive. The same may hold true of conceptual development.

Despite the large number of experimental studies devoted to the appraisal of the role of positive and negative examples in concept development, it is not possible to make a decisive statement about the relative merits of each. Mayzner feels that the negative example plays a very minor role in building a concept as compared to a multitude of positive

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[1]Bert Y. Kersh, "The Adequacy of Meaning as an Explanation for the Superiority of Learning by Independent Discovery," _Journal of Educational Psychology_, Vol. XLIX (1958), pp. 282-292.

[2]Martin Harrow and Alexander M. Buchwald, "Reversal and Nonreversal Shifts in Concept Formation Using Consistent and Inconsistent Responses," _Journal of Experimental Psychology_, Vol. LXIV (1962), pp. 476-481.

instances.[1] McDonald holds that the process by which the learner acquires the concept of a harbor, for example, is different from memorizing the definition of a harbor in that examples and "non-examples" are equally essential to learning the concept.[2] Experimental data do seem to point to the fact that there is no one best sequence of positive and negative instances. A synthesis of findings yields certain assumptions: students seem to prefer a mixture of both positive and negative examples; too many negative examples at the outset of learning tend to confuse some students; some negative examples increase accuracy of discrimination; practice on positive examples facilitates recognition of positive examples while practice on negative examples facilitates recognition of negative examples.

Data is accumulating to indicate that perhaps realistic experience is not as vital in the acquisition of many true concepts as has been thought. Witness the fact that some stereotypes may be attributed to narrow, initial, initial, realistic experience, stereotypes which might have been avoided through broader, more selective, vicarious experience. Recent research does support the supposition made by Hull in

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[1] M. S. Mayzner, "Verbal Concept Attainment: A Function of the Number of Positive and Negative Instances Presented," Journal of Experimental Psychology, Vol. LXIII (1962), pp. 314-319.

[2] Frederick J. McDonald, Educational Psychology, (San Francisco: Wadsworth Publishing Company, Inc., 1960), p. 143.

1920, that when the essential elements of a concept are stressed in learning situations, when the examples used are simple, clear, and free from extraneous cues, learning is faster and retention is improved.[1] In one instance, biology students were asked to learn the parts of a flower. One group was given a simplified diagram as an example while the other group was given real flowers. The students using the diagrams not only learned the parts more easily but pupils became more skillful in learning generalizations.[2]

In a study of the relative effects of irrelevant information supplied by both auditory and visual stimuli, Lordahl came to the conclusion that visual stimuli tend to take precedence over auditory stimuli in many situations;[3] a conclusion which might lead to an educational reevaluation of the visual cues provided in many learning situations.

Although concept learning is admittedly a crucial element in education, examination of further experimentation would only serve to emphasize the diversity of outcome and contravention of opinion. Almy offers the explanation that the reason so much confusion surrounds the use of the word

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[1] Clark L. Hull, "Quantitative Aspects of the Evolution of Concepts," Psychology Monographs, No. CXXIII (1920).

[2] G. W. Boguslavsky, "Psychological Research in Soviet Education," Science, Vol. CXXV (1957), pp. 915-918.

[3] Daniel S. Lordahl, "Concept Identification Using Simultaneous Auditory and Visual Signals," Journal of Experimental Psychology, Vol. LXII (1961), pp. 283-290.

"concept" itself is that it is used in different ways by the teacher, the psychologist, and the scientist. To the teacher, a concept is something he wants a child to learn; to the psychologist, a concept is a series of related meanings held by one individual; to the scientist, a concept inheres in the structure of his particular discipline. Almy further advocates that it is always expedient to draw a distinction between concepts which are "abstractable, public essential forms" and conceptions which are "individual mental images and symbols".[1]

If the nature of a concept is still many things to many people (a cognitive response distinctive of human beings,[2] a way of thinking based upon experience,[3] thoughts involving conservation, classification, and seriation[4]), the processes by which concepts are thought to be acquired are the focus of extensive contradictory experimentation.

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[1]Millie Almy, "Wishful Thinking About Children's Thinking?" Teachers College Record, (New York: Columbia University, February, 1961), pp. 396-405.

[2]Edna Heidbreder, "The Attainment of Concepts: I Terminology and Methodology," Journal of Genetic Psychology, Vol. XXXV (1946), pp. 173-189.

[3]M. C. Serra, "How to Develop Concepts and Their Verbal Representations," Elementary School Journal, Vol. LIII (1953), pp. 275-285.

[4]Jean Piaget, The Origins of Intelligence in Children, (New York: International University Press, 1952).

A summary of research dealing with concept formation, nonetheless, yields limited agreement, particularly as to the prime importance of generalization. Remembering that the adult human mind can deal with only seven independent pieces of information at once, the need to codify and condense becomes obvious.[1] The educator of today is often the target for the accusation that he fails to bring his students to the point of being able to find for themselves generic elements in enormous masses of information. Jerome Bruner sights the urgency of this task by stating that, "Facts simply learned without a generic organization are the naked and useless untruth."[2] Russell reiterates this judgment when he comments, "Finding the generic in perceptual experiences, memories, images, and imaginative thinking contributes to the emergence of concepts."[3] Woodruff notes the need for a shift from a curriculum centered about verbal facts to one of conceptualized knowledge, with emphasis on the organization of subject matter as well as recognition of the necessity of doing seriour intellectual work which involves the labor of changing ideas.[4]

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[1]Jerome S. Bruner, "Readiness for Learning," The Process of Education, (Cambridge: Harvard University Press, 1960).

[2]Jerome S. Bruner, "Learning and Thinking," Harvard Educational Review, Vol. XXIX, (1959), p. 185.

[3]David H. Russell, Children's Thinking, (Boston: Ginn and Company, 1956).

[4]Asahel D. Woodruff, "The Use of Concepts in Teaching and Learning," The Journal of Teacher Education, Vol. XV (1964), p. 94.

Discrimination is also thought to be involved in the formation of concepts but there is far more dissention over the part discrimination plays in concept development than over the principle of generalization. Should it, in fact, be termed "discrimination" or would "abstraction" be the better term? If abstraction is the better term, many psychologists and educators might contend that there is no longer a dichotomy of approach in building a concept, but that abstraction is merely a part of the broader field of generalization. For Woodruff, differentiation is the first process in concept formation which separates the entities in environment and thus makes it possible to (1) focus attention on the structural characteristics of the referents, or (2) on the function the referent is performing and the consequence which is being produced by that function, or (3) on the qualities of the referent, such as shape, color, morality, considerateness, gracefulness, efficiency, or speed.[1]

Broadly speaking, differentiation and generalization are commonly thought to be contributing factors in building a clear concept. With generalization and differentiation, thinking always in terms of the individual instance or the individual exception is superfluous.

In just what manner generalization and differentiation are best effected in the learning situation is speculative and

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[1]Asahel D. Woodruff, "The Use of Concepts in Teaching and Learning," op. cit., p. 88.

tentative. Woodruff[1] and Burlingame[2] have both offered a survey of determinants of ease and difficulty in concept learning which have experimental support. In synthesis they are:

1. Subject matter becomes more meaningful and more directly transferable to behavior when it is transformed from verbal form to conceptualized form.

2. Student behavior is most likely to be made responsive to the best in our vast modern knowledge when priority is given to the most useful instrumental concepts in all fields.

3. Serious conceptual content can be successfully handled in the first years of school provided it is graded to the general level of capacity and made available to students according to individual readiness.

4. Concept development proceeds faster and more accurately when the relevant features of the teaching materials are emphasized and the irrelevant features are counteremphasized.

5. Both positive and negative instances of a concept are helpful in concept learning, but positive instances are of the greatest value.

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[1] Ibid., p. 96.

[2] Mildred Burlingame, "Some Determinants of Concept Formation," The College of Education Record, Vol. II, (Moscow: University of Idaho, 1963), pp. 14-19.

6. New concepts take form faster when students are given cues and information as to what to look for in the learning material.

Curriculum planning in the future will not only involve many of the foregoing propositions concerning concept development, it will also be faced with the necessity of establishing a priority system since conceptual load seems continually to increase rather than diminish. The now classic work of Horn and his students urged the reduction of concepts in the social studies by the elimination of less essential ones so that the ones that remained might form the basis for better learning.[1] Although this work is cited again and again in the literature of social studies instruction, practical results are difficult to trace. Brownell and Hendrickson contend that the reason why people generally are insensitive to the largeness of the number of concepts in the school curriculum is that they tend to oversimplify the psychological nature of concepts, and thus to minimize the difficulties they present for learning.[2]

Corollary to the increased and complex conceptual load in the curriculum is the need for putting subject matter

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[1]Ernest Horn, Methods of Instruction in the Social Studies, (New York: Charles Scribner's Sons, 1937).

[2]William A. Brownell and Gordon Hendrickson, Learning and Instruction, National Society for the Study of Education Forty-ninth Yearbook, Part One. (Chicago: University of Chicago Press, 1950).

into conceptual form. Sequencing this subject matter into efficient hierarchies would seem to be a part of teaching method, although Gagne concludes that principles derived from studies of methods of teaching provide little help in making learning efficient. Attempts to manipulate learning conditions, whether carried out by a teacher or by the designer of a teaching machine, must employ much art and not much science at the present stage of knowledge.[1] This situation is a result of the lack of a unified science of learning. Even so, the science of learning as it exists today and the management of learning in the classroom must be mutually supporting. Ausubel believes that much additional research is needed at the "engineering level" of operation before the implications of developmental findings can become useful in everyday school situations.[2] If educators agree with Russell that the clarity and completeness of a child's concepts are the best measure of his probable success in school[3]; if they agree with Furth that the more intelligent child may be the one who can control his behavior more consistently and more successfully by means of

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[1] Robert M. Gagne and Robert C. Bolles, "A Review of Factors in Learning Efficiency," Automatic Teaching: The State of the Art, ed. E. H. Galanter (New York: John Wiley and Sons, Inc., 1959), pp. 13-53.

[2] David P. Ausubel, "Viewpoints from Related Disciplines: Human Growth and Development," (New York: Teachers College Record, Vol. LX), pp. 245-254.

[3] David H. Russell, Children's Thinking, (Boston: Ginn and Company, 1956).

conceptual principles[1], then any approach which might appear to offer a means of conceptual clarification would seem to be worthy of investigation.

It is interesting to note that people concerned with concept development frequently illustrate their ideas by using geographic terms such as island, river, harbor, bank, or sound. Why this should be so is difficult to assess. Possibly it is because some of these terms present conceptual problems as they are used in a variety of contexts. Consider the term "sound" as it might be used by the average person: "What was that sound?" "A sound proposal . . . ," "Sound the alarm!" "A small buoy in the sound . . . "; or the term, "bank": "The airplane banks . . . ," "Money in the bank . . . ," "Something to bank on . . . ," "On the bank of a river . . . ".

Conversely, it may be that writers use these terms as illustrations simply because they represent broad classes or categories which are supposedly used in a meaningful way by almost everyone. Therefore, whether these terms are often used as illustrations because they represent concepts which are assumed to be exceedingly clear or exceedingly complex is uncertain. What is certain is the frequency with which terms such as isthmus, canal, lake, strait, and bay occur in the

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[1]Hans G. Furth, "Conceptual Discovery and Control on a Pictorial Part-Whole Task as a Function of Age, Intelligence and Language," Journal of Educational Psychology, Vol. LIV, (August, 1963), p. 195.

daily newspaper, the telecast, and the sidewalk conversation. The knowledgeable citizen of today must be able to use these words with some degree of accuracy. If culture results from man's biological organism, his geographic environment, and his tradition,[1] and if it is true that when children understand the concept of culture, they have a basis for interpreting their own behavior and the behavior of others, then knowledge of certain everyday geographic terms would seem to constitute a cultural imperative.

Statement of the Problem

It will be the purpose of this study to ascertain which of the following presentation modes might be most efficient in clarifying certain geographic concepts for selected sixth-year pupils of average ability: photographs, verbal definitions, filmstrips, diagrammatic drawings, or three-dimensional models. In an attempt to do this, a survey of all state-adopted social studies texts for fourth and fifth grades will be made to ascertain which terms have been used most frequently. These commonly used words which denote certain features of the earth will then be used as the nucleus of an achievement test which should indicate those geographic terms for which many children have unclear concepts.

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[1] I. James Quillen, "What Are the Basic Concepts to Be Developed in Children?" Childhood Education, Vol. XXIII (1947), pp. 405-409.

The primary concern of this study is the determination of a presentation mode or method which seems to be most conducive to more precise usage and understanding of the so-called grammar of geography. Five different modes will be considered: (1) photographs in conjunction with conventional wall maps, (2) verbal definitions, (3) filmstrips, (4) diagrammatic transparencies, (5) three-dimensional models.

It will not be the purpose of the study to suggest that there are wide gaps, inaccuracies, and faulty conceptions which must be bemoaned as a result of present educational methods. This would imply a certain naiveté in view of the tremendous conceptual load of contemporary curriculum. Rather it is a source of some amazement that children develop as many accurate concepts as they do. Nor is the intention of the study to suggest that educators should try for completeness at the time concepts are introduced. Brownell and Hendrickson warn that only rarely should the teacher attempt such closure. They add, realistically, that it is both impossible and undesirable to teach all concepts thoroughly.[1] Concepts are necessarily incomplete until home, school, community, and the wider world provide experiences against which to check the validity of a generalization.

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[1] William A. Brownell and Gordon Hendrickson, Learning and Instruction, ed. Nelson B. Henry (Chicago: University of Chicago Press, 1950), p. 113.

The problem then, is the appraisal of five possible ways of improving rather than completing concepts of common geographical terms as they are used by certain sixth-year pupils of average academic ability.

Design of the Study

There are eighteen fourth and fifth grade social studies and geography books on the state-adopted textbook list for Oklahoma. These books were surveyed to determine which features of the earth were mentioned most frequently. Books included in the survey can be found in Appendix I. Those terms which were given extensive descriptive and definitive treatment by at least six books on the state list were arbitrarily selected for use in an achievement test.

An intensive search was made to find a test which would not only cover most of the terms yielded by the survey, but which would also minimize the bias incurred by reading ability. No available standardized test seemed to fill these requirements, so a test was devised which is described in Chapter Two.

The population for this investigation was then chosen from the Midwest City Elementary Schools in Midwest City, Oklahoma. Since, within a school, Midwest City assigns its pupils on the basis of ability grouping, it was assumed that the groups would be of comparable ability. Subjects for the study were drawn from classes composed of "average ability" pupils who had been grouped on the basis of intelligence quotient scores (California Mental Maturity Test), achievement test scores (Iowa Test of Basic Skills), and teacher judgment. The achievement pretest was administered to the entire sample of five sixth grade classes. From the sample, forty girls and forty boys were selected by using a table of random numbers. They were then assigned in groups of eight to each of the following: Group One, using vertical and oblique aerial photographs as a possible means of conceptual clarification; Group Two, using verbal definitions; Group Three, using filmstrips utilizing representational art; Group Four, using diagrammatic drawings on transparencies; Group Five, using three-dimensional models.

Since no reinforcement of any kind was given following the pretest, it was possible to use the same instrument as a posttest, although a very real limitation of this investigation was the phenomenon often noted by educational researchers and pinpointed by Diederich.[1] Namely, in any test-retest situation, pupils with the lowest initial scores appear to gain the most, and pupils with the highest initial scores appear to have gained the least. This seems to be true not only of cognitive tests, but also of tests which are designed to measure attitudes and appreciations. Until testing-retesting is put on a different basis, true measurement

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[1] Paul B. Diederich, "Pitfalls in the Measurement of Gains in Achievement," School Review, (Vol. LXIV, 1959), pp. 59-63.

of growth appears difficult to approximate. So the conventional test-retest approach was used in this study as the only feasible way of showing achievement gains that is presently available.

The scores of the pretest were used as a criterion and following the instructional period an analysis of covariance was done on the data yielded by the five groups to test these null hypotheses:

1. There are no significant differences in the five instructional groups in their tendency to improve their scores on the geographic terms achievement test.

2. There are no sex differences within each instructional group in their tendency to improve their scores on the geographic terms achievement test.

3. There is no relationship between sex and method in the instructional groups in their tendency to improve their scores on the geographic terms achievement test.

CHAPTER II

THE MEASURING INSTRUMENT

Objectives of the Test

The attempt to locate an appropriate appraisal instrument which would measure the level of pupil proficiency in using the geographical terms of the survey was futile, since none of the available tests appeared to meet the particular specifications required by the design of the study. These specifications were directly related to the objectives of the test. (1) The test should cover the concepts or terms which occur most frequently in the textbook survey. (2) Content of the test must be appropriate for the interest level and attention span of the population with whom the study is concerned. (3) The test should be comparatively easy to administer in a variety of settings. (4) Outcome of the test should be, in so far as possible, unaffected by the potential bias of reading disability. (5) The test must have objectivity, reliability, and validity. An effort to incorporate the preceding objectives resulted in the measuring instrument which was ultimately used in this study.

Description of the Test

Several groups of children were tested in a preliminary test draft, using an initial construction which proved to be much too long and somewhat ambiguous. It was at this point in the investigation that the idea of including all geographic terms used in six or more textbooks was discarded. It became obvious that the attention span of the eleven-year-old pupil invalidated this admittedly arbitrary approach. After a major revision, the test was reduced in number of items to such an extent that Part One could be given in twenty minutes; Part Two could also be given in approximately twenty minutes.

Part One of the test consisted of thirty-three multiple choice items which were first read aloud to the pupil as he read them silently. In the case of those features which were characterized by two-dimensional portrayal, such as a river, the feature was simply pointed out on the thirty-five millimeter color slide especially prepared by the Audio-Visual Department of the Oklahoma City Public Schools, which encompassed all the features to be tested in Part One.

Part Two, on the other hand, was made up of items which were not amenable to the two-dimensional medium. It was here that an attempt was made to utilize the interest of the child in multimanned space flights. A hypothetical situation was suggested in which the pupils were asked to be telemetry experts who were recording the correct data from the descriptions which were being sent back to earth by both the automatic recording devices and the astronauts. The test as it was finally used can be found in Appendices Two and Three.

The children who took the test participated very actively and were slightly disconcerted when they were not given immediate reinforcement. They wanted to know without delay if they had responded correctly; they found it hard to understand why it was impossible to discuss the plausibility of their various answers at the time. This sustained interest appeared to indicate that the objective of content adjustment to attention span had been, at least, partially attained.

The third objective, ease of administration, was facilitated by daylight screens which the Midwest City Elementary Schools have in their classrooms. Because the test was given in the regular classroom, pupils had the benefit of a normal, comfortable, physical setting.

The reduction of reading disability bias was the fourth objective. Although homogeneous grouping of subjects tended to screen out reading problems characteristic of dull-normal pupils, preliminary conferences with faculty and administration revealed the existence of some reading disability in these children although their intelligence quotient scores were in the normal range. This is not uncommon since reading problems have been found to exist in children of all levels of ability. Reading aloud each multiple choice test item as the feature was pointed out on the screen freed poorer readers from their tremendous burden of word attack. The narrative section (Part Two) of the test was also done orally.

The fifth objective of the measuring instrument was that it have three evaluative criteria: objectivity, reliability, and validity.

Objectivity of the Test

Only one response to each test item was considered the correct response, so subjective judgments were not required for scoring the test. In a few cases, pupils responded to questions by circling two responses and then writing a qualifying statement or phrase above the second response which would serve to make it a correct one. In these cases, credit was given for one correct response to the item.

Reliability of the Test

Part One and Part Two of the test were divided into two similar sub-tests, namely a test of twenty-six odd-numbered items and a test of twenty-six even-numbered items. The data used for computing test reliability are shown in Table 1.

Because the assumptions underlying the method of rational equivalence (using the Kuder-Richardson formula for example) are the same as those underlying the correlation of

TABLE 1

DATA USED FOR COMPUTING THE RELIABILITY OF THE TEST

Total Score on Even Numbered Items	Total Score on Odd Numbered Items
15	19
18	18
15	14
15	18
19	17
21	17
19	18
20	11
15	16
16	15
16	19
14	18
24	18
18	22
20	19
18	21
22	21
19	19
17	18
21	17
15	18
16	17
18	18
20	17
21	20
22	19
18	19
24	21
17	17
18	19
24	22
21	18
13	13
15	15
15	17

TABLE 1--Continued

Total Score on Even Numbered Items	Total Score on Odd Numbered Items
21	21
16	14
14	14
14	15
15	17
11	6
15	11
17	16
20	19
12	15
15	15
13	13
16	12
19	21
11	16
9	14
16	20
12	18
13	14
15	20
11	13
19	18
11	15
17	18
17	18
9	16
19	18
14	14
14	14
14	14
10	13
17	17
14	17
20	20
15	14

TABLE 1--Continued

	Total Score on Even Numbered Items	Total Score on Odd Numbered Items
	12	13
	19	18
	21	15
	20	18
	21	18
	17	16
	14	15
	15	14
	16	17
	14	12
	16	17
Total	1339	1348

odd and even items (using the Spearman-Brown formula),[1] and because these two methods will yield similar estimates of the reliability of a test to the extent that the test items measure the same function, the Spearman-Brown formula was chosen because of its expediency. (See Table 2.)

TABLE 2

THE COEFFICIENT OF CORRELATION BETWEEN ODD AND EVEN ITEMS USING THE DEVIATION SCORE METHOD

$$r_{oe} = \frac{\Sigma xy}{\sqrt{(\Sigma x^2)\ (\Sigma y^2)}}$$

$$\Sigma xy = 22768 - \frac{(1339)\ (1348)}{80} = 205.85$$

$$\Sigma x^2 = 23099 - \frac{(1339)^2}{80} = 687.49$$

$$\Sigma y^2 = 23088 - \frac{(1348)^2}{80} = 374.20$$

$$r_{oe} = \frac{205.85}{\sqrt{257258.7580}} = 0.406$$

[1] James E. Wert, Charles O. Neidt, and J. Stanley Shmann, Statistical Methods in Educational and Psychological Research, (New York: Appleton-Century-Crofts, Inc., 1954), p. 334.

After the coefficient of correlation between odd and even items on the test had been determined, it was used to estimate the coefficient of reliability of the test as a whole by the Spearman-Brown modified formula. This estimate is based on the premise that had the test been twice as long as either of the half-tests, the expected coefficient of reliability would be 0.58. (See Table 3).

TABLE 3

COEFFICIENT OF RELIABILITY OF THE TEST

$$r_{xx} = \frac{2r_{oe}}{1 + r_{oe}}$$

$$r_{xx} = \frac{2(.41)}{1 + .41} = \frac{.82}{1.41} = 0.58$$

The standard error of measurement or the standard error of the test score is such that in a large group of subjects, the true score of ninety-five out of every one hundred subjects would be within their obtained score plus or minus the product of 1.96 times 1.616 or 3.1456. (See Table 4).

Validity of the Test

The criterion which was chosen as yielding the most objective measurement of the characteristic being studied,

TABLE 4

THE STANDARD ERROR OF TEST SCORE

$$\text{S. E. of Test Score} = \sqrt{1 - r_{xx}}$$

$$2.104 \sqrt{0.58} = 1.616$$

namely the ability to form accurate concepts, was the score derived from the California Test of Mental Maturity which had been administered to all the groups in the study. Since the size of a coefficient of correlation between test scores and a criterion is a function of the range of talent in the group in which it has been computed[1], an obtained coefficient will be lower when computed in a homogeneous group such as the sixth-year students in the study. These children were placed in ability groups at the beginning of the school year on the basis of test scores and teacher judgment. The homogeneity of this group then could tend to lower the size of the coefficient of correlation.

The deviation score method of computation was used to obtain the predictive effectiveness between the scores on the test measuring the accuracy of geographical concepts and the scores on the California Test of Mental Maturity. (See Table 5).

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[1]James E. Wert, Charles O. Neidt, and J. Stanley Shmann, op. cit., p. 329.

TABLE 5

PREDICTIVE EFFECTIVENESS BETWEEN THE TEST MEASURING GEOGRAPHICAL CONCEPTS AND THE CALIFORNIA TEST OF MENTAL MATURITY

$$r_{xy} = \frac{\sum xy}{\sqrt{(\sum x^2)\ (\sum y^2)}}$$

$$r_{xy} = \frac{295,686}{309,541} = 0.95$$

Since the coefficient of validity, or more properly, the estimated predictive effectiveness proved to be .95, the evidence would seem to point to an inherent relationship between the test scores and the criterion.

Curricular validity of a measuring instrument is established when such materials as textbooks in the field, and courses of study are examined, and an effort is made to include such material in the test. Curricular validity is also known as logical validity.[1] The geographic terms achievement test could be said to have logical or curricular validity as a result of the textbook survey upon which the test was based.

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[1] Deobold B. Van Dalen, Understanding Educational Research, (New York: McGraw-Hill Book Company, Inc., 1962), p. 264.

Relative Difficulty of Test Items

The ten terms missed most frequently on the geographic terms achievement test were: savanna, pampas, steppes, tundra, fiords, gulf, divide, isthmus, sound, and cape. (For an item analysis which includes all test terms and error frequency, see Appendix IV). Anglicized terms and terms beyond the first-hand experiential background of the pupils seem to have presented the greatest difficulties. Such terms as oasis, jungle, dike, and desert would also seem to be beyond the experiential background of most children, yet they were terms missed only rarely. Exotic imagery and vividness of concept connected with these words may be mentioned only as postulated variables which might account for this discrepancy.

Variability of Test Scores

The mean score for the geographical terms achievement test was 33.10, and the standard deviation was 5.70. The mean intelligence quotient score for the pupils in the study was 111.89, and the standard deviation was 13.510. Comparison of the two estimates of variance may be made by noting that 32.50 per cent of the achievement test scores fell in the sigma above the mean, whereas 53.75 per cent of the intelligence scores were in this deviation unit; 18.75 per cent of the achievement test scores occurred between the first and second standard deviation above the mean, whereas only 3.75 per cent of the intelligence scores were in the same position;

2.50 per cent of the geographic terms test scores were in the third deviation above the mean, and there were no intelligence test scores falling in this area of the distribution.

In the sigma below the mean, 36.25 per cent of the achievement test scores and 31.25 per cent of the intelligence test scores clustered. Percentages for both tests showed some similarity in the second sigma below the mean with 10 per cent of the achievement test scores and 11.25 per cent of the intelligence test scores recorded in this range. No score appeared in the third sigma below the mean for either test.

Area relationships within the two distributions show parity below the means. Greater differences are revealed in the comparison of the two relationships in the areas above their respective means.

CHAPTER III

EXPERIMENTAL PROCEDURE

The Period of Instruction

Geographical terms, identified in the achievement test as those for which the pupils in the study had inaccurate concepts, formed the basis for a problem solving period which took place one week after the administration of the test. Each of the five groups then used a different presentation mode as an aid in making comparisons and contrasts during this fifty-minute period. The writer provided the initial impetus for the discussion and in most of the groups the children became involved almost immediately.

It has often been noted that children not only need to know what concepts are, but also what they are not. Positive and negative examples are both often necessary for adequate concept formation. Hence, a large part of the instructional period was spent in clearing away many misconceptions. Clarification was directed toward exploring why misconceptions might have come about in the first place, rather than simply substituting a correct term for an incorrect one.

Pupils often seemed perplexed by the apparent sameness of features which are given different labels by geographers. Comments such as these were typical: "Mountains in Oklahoma are just hills in some other states . . . "; "Straits, channels, sounds, . . . they all look alike to me"; "That place can be called a marsh or a swamp, they mean the same thing."

The problem was then identified as one of isolating irrelevancies and emphasizing relevant cues; problem solving took the form of naming hypothetical features portrayed by the various modes. Names were suggested, sifted, given due deliberation, and adopted in view of their suitability. Reflecting an interest in the news of the moment at the time of this investigation, children offered such suggestions as Goldwater's Strait and Rockefeller's Canyon, ideas which struck them as wonderfully clever plays on names.

If generalizations are the final achievement, or capstones of conceptual learning, then it is hoped that at least a few resulted from this problem solving approach. Pupils decided that there were several broad generalizations which would help them give more appropriate names to the features which they were naming in the experimental period, and which would help them remember the names of the ones which are known to the world. First of these generalizations was that often more must be known about a geographic feature than just outward appearance before it can be given a name that would describe it adequately. Another important generalization concerned the relativity of size; for example, landforms are large or small only as they are compared to other landforms. A third generalization involved a somewhat tentative conclusion on the part of the children that most geographical features of the earth seemed to govern the existence of man rather more than he is able to change their forms. This generalization was made tentative by the profundity of a statement by one child who observed that if man chose, he might unleash atomic power and change the entire world in a matter of minutes.

The Presentation Modes

Vertical and oblique aerial photographs which were thought to illustrate most clearly the features or terms with which the children needed help were used with Group One. Pictures which were too small for efficient group use were enlarged by use of an opaque projector.

After certain features such as a sound or an isthmus were identified and discussed using the photographs, they were pointed out on a conventional wall map. Some of the terms used, of course, could not be found in identifiable form on the conventional map. This presentation mode stimulated a flow of divergent thinking when the discussion of perspective in photography was mentioned. This discussion was reminiscent of the Piaget demonstration of the growth of a child's perspective as related to a cardboard mountain range.[1]

Ragan and McAulay suggest that in using pictures, a teacher must always try to help the child perceive what he is expected to see in a picture.[2] In Group One, this task was complicated by the fact that there are often many geographic features in a single photograph and perception is not pinpointed by singularity.

The pupils in Group Two were given individual copies of the terms selected from the textbook survey. With these terms were simple definitions frequently found in the state-adopted texts, and verified by reference to A Dictionary of Geography.[3] These definitions may be found in Appendix V. It is an interesting commentary on attitude to note that the pupils in this group accepted the written definitions without protest or question. How sacrosanct the written word is was demonstrated by the fact that some of the pupils in other groups requested "study sheets" after they found that some of their friends had been given them. After the first flickering interest faded, these written definitions were largely

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[1]Jean Piaget, "How Children Form Mathematical Concepts", Scientific American, (Vol. CLXXXIX, No. V, November, 1953), p. 74.

[2]William B. Ragan and John D. McAulay, Social Studies for Today's Children, (New York: Appleton-Century-Crofts, Meredith Publishing Company, 1964), p. 283.

[3]W. G. Moore, A Dictionary of Geography, (Great Britain: Hunt, Barnard and Company, Ltd., 1959).

ignored by the pupils in this group; within two weeks they had, for the most part, been lost or misplaced. It is tempting to venture a guess as to how many times the carefully prepared "study sheet" made out by the conscientious teacher suffers the same fate.

With Group Three, filmstrips were used which portrayed a stylized representation of what the human eye might see of land and water features both from the air and on the ground. Three filmstrips from the Surface Features Series by the Jam Handy Corporation were found to be most appropriate.

Written explanations appear on each frame in this series; the vocabulary is controlled and presented no obvious meaning difficulties. Nonetheless, the text was read aloud to the pupils as each frame came into view.

Interaction between pupils and pupils and instructor appeared to be at a minimum in this instructional group. Difficulty in eliciting comparisons and contrasts might be attributed to the setting, or the medium, to the subjects or to the investigator. It may be that this lack of interaction could be accounted for by the inherent lack of appeal which the filmstrip has in comparison with other media.[1]

The presentation mode used in Group Four seemed to lend itself to what Bruner calls the "hypothetical mode" of

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[1]William B. Ragan and John D. McAulay, Social Studies for Today's Children, op. cit., p. 282.

teaching in contrast to the "expository mode".[1] Namely, the teacher and pupil are in a more cooperative position with respect to that which in linguistics would be called "speaker's decisions". In this fourth group, diagrammatic of line drawings in three colors on acetate transparenties were used. There were prepared by the Art and Visual Department of the Oklahoma City Public Schools Educational Television Station. An extremely lightweight and maneuverable overhead projector allowed unhampered activity on the part of the pupils. They asked if they might use the acetate pencil to label some of the features, and to change some of them in such a way that they might be called by different names.

Three-dimensional models were used with Group Five. Commercially prepared relief models which were available were too complicated for the typical sixth-year pupil since these models were designed for use in advanced high school and college geography courses. Therefore, a burlap and plaster model was constructed which represented a hypothetical area containing features which had been included in the achievement test. The model was painted in four colors and was mounted so that children could work with it easily. Pupils in this group seemed to want to employ a tactual as well as an intellectual approach in their problem solving period. They asked to keep the model, and with the help of their regular classroom

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[1] Jerome S. Bruner, "The Act of Discovery" <u>Harvard Educational Review</u>, (Vol. XXXI, 1961), pp. 21-32.

teacher, they planned to populate the region with cities and towns, agriculture and industry, in places where they might assume that conditions and resources could support man and his enterprises.

Statistical Treatment of Data

Null hypotheses tested in the statistical design were:

1. There are no significant differences in the five presentation modes in their power to clarify concepts and hence to improve achievement gains on the geographic terms test.

2. There are no sex differences within each instructional group related to the tendency to improve achievement gains on the geographic terms test.

3. There is no interaction between sex and method in the instructional groups in their tendency to show achievement gains on the geographic terms test.

Since differences in scholastic aptitude could influence a pupil's response to the criterion, scores on the California Test of Mental Maturity were used as a control variable (see Table 6). Differences between pretest and posttest scores were used to determine achievement gains.

Initially, achievement gains were treated by a multiple classification analysis of covariance (see Table 7). Since there was no variance between sex, that is, the sex difference variance was zero, multiple classification was no

TABLE 6

DATA USED TO COMPUTE THE MEASURE OF PREDICTIVE EFFECTIVENESS

Pupil	X	Y	XY	X^2	Y^2
1	46	120	5520	2116	14400
2	37	118	4366	1369	13924
3	34	117	3978	1156	13689
4	46	123	5658	2116	15129
5	35	116	4060	1225	13456
6	40	114	4560	1600	12996
7	43	105	4515	1849	11025
8	41	105	4305	1681	11025
9	36	117	4212	1296	13689
10	35	124	4040	1225	15376
11	40	120	4800	1600	14400
12	34	125	4250	1156	15625
13	33	112	3696	1089	12544
14	38	114	4332	1444	12996
15	38	120	4560	1444	14400
16	33	124	4092	1089	15376
17	42	115	4830	1764	13225
18	31	125	3875	961	15625
19	39	113	4407	1521	12769
20	34	114	3876	156	12996
21	31	122	3782	961	14884
22	33	122	4026	1089	14884
23	31	105	3255	961	11025
24	37	104	3848	1369	10816
25	38	106	4028	1444	11236
26	36	115	4140	1296	13225
27	41	112	4592	1681	12544
28	37	120	4440	1369	14400
29	29	108	3132	841	11664
30	36	121	4356	1296	14641

TABLE 6--Continued

Pupil	X	Y	XY	X^2	Y^2
31	34	111	3774	1156	12321
32	39	94	3666	1521	8836
33	26	119	3094	5676	14161
34	29	94	2726	841	8836
35	31	115	3565	961	13225
36	42	115	5830	1764	13225
37	30	103	3090	900	10609
38	28	124	3472	784	15376
39	30	98	2940	900	9604
40	30	93	2790	900	8649
41	19	106	2014	361	11236
42	25	112	2800	625	12544
43	34	94	3196	1156	8836
44	39	110	4290	1521	12100
45	28	116	3248	784	13456
46	30	98	2940	900	9604
47	24	113	2712	576	12769
48	28	120	3360	784	14400
49	24	110	2640	576	12100
50	42	113	4746	1764	12769
51	22	133	2926	484	17689
52	35	124	4340	1225	15376
53	29	114	3306	841	12996
54	28	100	2800	784	10000
55	35	110	3850	1225	12100
56	24	121	2904	576	14641
57	37	117	4329	1369	13689
58	26	120	3120	676	14400
59	35	104	3640	1225	10816
60	35	102	3570	1225	10404
61	26	113	2938	676	12769
62	37	110	4070	1369	12100
63	28	107	2996	784	11449
64	28	131	3668	784	17161
65	33	105	3465	1089	11025

TABLE 6--Continued

Pupil	X	Y	XY	X^2	Y^2
66	27	105	2835	729	11025
67	31	98	3038	961	9604
68	29	101	2929	841	10201
69	29	98	2842	841	9604
70	32	114	3648	1024	12996
71	39	98	3822	1521	9604
72	40	110	4400	1600	12100
73	29	113	3277	841	12769
74	37	109	4033	1369	11881
75	25	127	3175	625	16129
76	29	112	3248	841	12544
77	40	101	4040	1600	10201
78	29	121	3509	841	14641
79	34	99	3366	1156	9801
80	22	99	2178	484	9801
Total	2648	8950	295686	90220	1008156

X -- Score on the geographic terms achievement pretest

Y -- Score on the California Test of Mental Maturity

TABLE 7

SUMS AND MEANS OF THE CRITERION (GAIN IN TEST SCORE) AND CONTROL VARIABLE (INTELLIGENCE QUOTIENT SCORE) OF SIXTH GRADE PUPILS

Method	Number	Gain in Test Score		Intelligence Quotients	
		ΣX	$\bar{X}$	ΣY	$\bar{Y}$
Group I					
Male	8	51	6.375	918	114.75
Female	8	56	7.00	956	119.50
Subtotal	16	107	6.687	1874	117.125
Group II					
Male	8	78	9.75	920	115.00
Female	8	54	6.75	887	110.875
Subtotal	16	132	8.25	1807	112.938
Group III					
Male	8	64	8.00	861	107.75
Female	8	93	11.625	869	108.625
Subtotal	16	157	9.812	1730	108.188
Group IV					
Male	8	82	10.25	925	115.625
Female	8	112	14.00	904	113.00
Subtotal	16	194	12.125	1829	114.3125
Group V					
Male	8	109	13.625	829	103.625
Female	8	69	8.625	881	110.125
Subtotal	16	178	12.125	1710	106.925
TOTAL	80	768	9.799	8950	111.8976

ΣX -- Sum of gains on geographic terms test.
$\bar{X}$ -- Mean score on geographic terms test.
ΣY -- Sum of scores on Calif. Test of Mental Maturity.
$\bar{Y}$ -- Mean score on Calif. Test of Mental Maturity.

longer necessary and hypotheses two and three were accepted without further investigation (see Table 8).

Posttest data gathered two weeks after the period of instruction (see Tables 9, 10 and 11) were then treated by an analysis of covariance and this analysis is summarized in Table 12. These findings led to the rejection of the first hypothesis, and to the enumeration of ten sub-hypotheses as factors which were instrumental in this rejection.

TABLE 8

DEVIATION FORM SUMS OF SQUARES AND CROSSPRODUCTS
FOR ALL SOURCES OF VARIATION

Source of Variation	Σx^2	Σy^2	Σxy
Total	2170.2	6499.7	-2239.0
Method	304.825	804.0	- 303.9
Sex	0.0	24.2	0.0
Interaction	246.375	334.7	-9053.4
Within	1619.0	5336.8	7118.3

Σx^2 -- Sum of the squared deviations, gains on geographic terms achievement test.

Σy^2 -- Sum of the squared deviations, California Test of Mental Maturity.

Σxy -- Sum of cross products.

TABLE 9

WORK SHEET

Photographs		Verbal Definitions		Film Strips		Diagrammatic Trans-parencies		Three Dimensional Models	
I		II		III		IV		V	
X	Y	X	Y	X	Y	X	Y	X	Y
42	40	46	47	26	36	24	45	33	47
31	40	37	47	29	39	42	47	27	37
39	41	34	41	31	45	22	35	31	44
34	47	46	46	42	45	35	46	29	39
31	42	35	41	30	42	29	38	29	40
33	33	40	43	28	36	28	35	32	35
31	47	43	47	30	39	35	39	39	47
37	37	41	46	30	44	24	44	40	46
38	46	36	47	19	42	37	46	29	41
36	47	35	46	25	36	26	46	37	46
41	50	40	38	34	38	35	44	25	48
37	47	34	44	39	46	35	47	29	44

TABLE 9--Continued

Photographs		Verbal Definitions		Film Strips		Diagrammatic Trans-parencies		Three Dimensional Models	
I		II		III		IV		V	
X	Y	X	Y	X	Y	X	Y	X	Y
29	46	33	46	28	33	26	38	40	50
36	50	38	45	30	39	37	47	29	34
34	45	38	45	24	30	28	43	34	48
39	42	33	47	28	40	28	45	22	37
Subtotals:									
568	700	609	716	475	630	491	685	505	683
TOTAL X -- 2648									
TOTAL Y -- 3414									
Mean Scores:									
35.5	43.75	38.06	44.75	29.68	39.375	30.68	42.81	31.56	42.68

X -- Pretest score, geographic terms test

Y -- Posttest score, geographic terms test

TABLE 10

SUMS OF SQUARES AND SUMS OF PRODU(

Photographs I			Verbal Definitions II			Film Strips III		
X^2	xy	Y^2	X^2	xy	Y^2	X^2	xy	Y^2
1764	1680	1600	2116	2162	2209	676	936	1296
961	1240	1600	1369	1739	2209	841	1131	1521
1521	1599	1681	1156	1394	1681	961	1395	2025
1156	1598	2209	2116	2116	2116	1764	1890	2025
961	1302	1764	1225	1435	1681	900	1260	1764
1089	1089	1089	1600	1720	1849	784	1008	1296
961	1457	2209	1849	2021	2209	900	1170	1521
1369	1369	1369	1681	1886	2116	900	1320	1936
1444	1748	2116	1296	1692	2209	361	798	1764
1296	1692	2209	1225	1610	2116	625	900	1296
1681	2050	2500	1600	1520	1444	1156	1292	1444
1369	1739	2209	1156	1496	1936	1521	1794	2116
841	1334	2116	1089	1518	2116	784	924	1089
1296	1800	2500	1444	1710	2025	900	1170	1521
1156	1530	2025	1444	1710	2025	576	720	900
1521	1638	1764	1089	1551	2209	784	1120	1600
TOTALS:								
20386	24865	30960	23455	27280	32150	14433	18828	25114

$X^2 = 90220$ $Y^2 = 146540$ $xy = 113239$

X^2 -- Geographic terms pretest score squared

Y^2 -- Geographic terms posttest score squared

xy -- Cross product of deviation

TABLE 11

DISPERSION ABOUT A REGRESSION LINE

	df	Σx^2	Σxy	Σy^2
Among means	4	727.88	376.11	261.89
Within groups	75	1830.82	-140.51	585.66
Total	79	2558.7	235.6	847.55

df -- Degrees of freedom

Σx^2 -- Sum of deviations squared (geographic terms pretest)

Σy^2 -- Sum of deviations squared (geographic terms posttest)

Σxy -- Sum of the cross products

TABLE 12

ANALYSIS OF COVARIANCE

	df	Σx	Σxy	Σy	df	Σy	Mean Square
Among means	4	727.88	376.11	261.89	4	243.24	60.81
Within groups	75	1830.82	-140.51	585.66	74	574.88	7.76
Total	79	2558.7	235.6	847.55	78	818.12	

$$F = \frac{60.81}{7.76} = 7.83$$

$$F \quad .95 \quad (4, 74)$$

Here there is significance at the 5 per cent level for differences in means of the y values among the groups after the y values have been adjusted by the within-groups coefficient b_w. The test of significance of differences in the y means not making use of the x values would give

$$F = \frac{\frac{261.89}{4}}{\frac{585.66}{74}} = 8.27$$

TABLE 13

t-TEST FOR DIFFERENCE BETWEEN MEANS OF THE GAINS RESULTING FROM THE FIVE TEACHING METHODS

Method Comparisons		Significance
Between I and II:		
$\frac{1.563}{3.268}$	= .47	not significant
Between I and III:		
$\frac{1.562}{3.465}$	= .45	not significant
Between I and IV:		
$\frac{3.875}{4.2508}$	= .911	significant at the .01 level (.606)
Between I and V:		
$\frac{3.875}{4.249}$	= .911	significant at the .01 level
Between II and III:		
$\frac{3.125}{3.465}$	= .901	significant at the .01 level
Between II and IV:		
$\frac{5.445}{3.9560}$	= 1.376	significant well beyond the .01 level
Between II and V:		
$\frac{5.445}{3.701}$	= 1.471	significant well beyond the .01 level

TABLE 13--Continued

Method Comparisons			Significance
Between III and IV:			
$\frac{2.313}{4.404}$	=	.525	significant at the .05 level
Between III and V:			
$\frac{2.313}{4.1880}$	=	.552	significant at the .05 level
Between IV and V:			
no difference possible because of identical means			

CHAPTER IV

SUMMARY AND CONCLUSIONS

This study represents an attempt to determine the efficacy of five presentation modes (photographs, verbal definitions, filmstrips, diagrammatic drawings, three-dimensional models) in clarifying concepts of certain geographical terms. The estimate of conceptual clarification resulting from the instructional period in which these modes were used was based on an achievement test which incorporated commonly used terms in state-adopted textbooks for fourth and fifth grades. Eighty sixth grade pupils, randomly selected from classes which had been homogeneously grouped on the basis of standardized test scores and teacher evaluation, were the subjects.

To the degree that scholastic aptitude is controlled by intelligence quotients and to the degree that all other pertinent factors related to achievement in social studies have not introduced a bias within the limitations of this study, the following findings were made: (see Table 13)

1. There are some significant differences in the five presentation modes in their power to clarify concepts and hence to improve achievement gains on the geographic terms test:

(a) There were no statistically significant differences in the achievement gains made by pupils in Group One who used photographs as a means of conceptual clarification and those in Group Two who used verbal definitions.

(b) There were no statistically significant differences in the achievement gains made by pupils in Group One who used photographs as a means of conceptual clarification and those in Group Three who used filmstrips.

(c) Statistically significant at the .01 level of confidence was the variance found between Group One who used photographs and Group Four who used diagrammatic transparencies, with Group Four showing the greater gain in conceptual clarification as measured by the geographic terms test.

(d) Statistically significant at the .01 level of confidence was the variance found between Group One who used photographs and Group Five who used three-dimensional models, with Group Five showing the greater gain in conceptual clarification.

(e) Statistically significant at the .01 level of confidence was the variance found between Group Two and used verbal definitions and Group Three who used filmstrips, with Group Three showing a slight gain in conceptual clarification.

(f) Statistically significant at the .01 level of confidence was the variance found between Group Two who used verbal definitions and Group Four who used diagrammatic transparencies, with Group Four showing the greater gain in conceptual clarification.

(g) Statistically significant at the .01 level of confidence was the variance found between Group Two who used verbal definitions and Group Five who used three-dimensional models, with Group Five showing the greater gain in conceptual clarification.

(h) Statistically significant at the .05 level of confidence was the variance found between Group Three who used filmstrips and Group Four who used diagrammatic transparencies, with Group Four showing the greater gain in conceptual clarification.

(i) Statistically significant at the .05 level of confidence was the variance found between Group Three who used filmstrips and Group Five who used three-dimensional models, with Group Five showing the greater gain in conceptual clarification.

(j) There were no statistically significant differences in the achievement gains made by Group

Four who used diagrammatic transparencies as a means of conceptual clarification and Group Five who used three-dimensional models. These two methods appear to be equally effective in clarification of geographic terms.

2. There was no statistically significant difference between boys and girls in achievement gains on the geographical terms achievement test.

3. There was no interaction between sex and method.

The results indicate that photographs, verbal definitions, and filmstrips, three modes commonly used in the elementary classroom, were not as effective in the development of the selected geographic concepts as diagrammatic drawings and three-dimensional models.

Some intervening variables which might account for the apparent superiority of the diagrams and models could be: (1) the absence of extraneous and irrelevant perceptual cues in these modes, (2) the degree of concreteness in the case of the models, (3) the novelty of usage, (4) the divergency of group thinking fostered by the use of these modes.

Although the primary concern of this study was not the effect that degree of concreteness has on problem solving, it would seem that this factor influenced the outcome. For every instance of recent research indicating that varying concreteness has little to do with ability to find solutions

(Saugstad, Lorge, Tuckman, Aikman, Spiegel, and Moss[1]), there are counterparts showing the clear-cut effects of varying concreteness (Cobb, Brenneise, and Gibb[2]). Concurring with the latter group in this study are the minimal gains of the verbal definitions group (least concrete) as opposed to the maximal gains of the group using the three-dimensional models (most concrete).

That the two groups of children who experienced the greatest conceptual clarification of terms as evidenced by the achievement gains on the test, seemed also to be the groups who evinced the most divergent thinking during discussion periods is an entirely subjective evaluation. Whether this apparent divergency was prompted by the modes themselves (the diagrammatic drawings and the three-dimensional models) or was an element of particular group dynamics is a moot question.

Though it was beyond the scope of this study, new and meaningful implications might have come from a measurement of the flow and the amount of divergency in pupil response as their discussion centered around the concepts being presented. In more elaborate research, a recording device might have been used so that a flow chart could be prepared, a chart

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[1] Carl P. Duncan, "Recent Research on Human Problem Solving," Psychological Bulletin, Vol. LVI, 1956, pp. 397-429.

[2] Ibid., pp. 397-429.

which also might estimate number and quality of convergent-divergent observations stimulated by use of the various presentation modes.

Recent experiments have raised doubts about the importance of methods differences which are defined in terms of broad intent or specific teacher activities, rather than the experiences which the learner has. It has been the intent of this study to focus on the learning experience of the child rather than to suggest the structuring of any particular teaching method. Yet opportunities for perceptual growth are still limited by environmental factors, despite the fact that textbook authors and creative teachers make use of pictures, maps, graphs, tables, and a rich variety of corollary activities. Differences between the perceptions of urban and rural children, northern and southern children, mountain and plains children, landbound and coastal children are being minimized by improved communication media, but they exist. A platitude worth constant re-examination is the fact that it is necessary to help children build accurate concepts by differentiations and generalizations accomplished through vicarious or symbolic exposure.

Certainly the limitation of time and the expanded curriculum to which everything seems to be added and nothing taken away are two reasons to continue the search for ways to make the acquisition of concepts through symbolic exposure as effective and efficient as possible. To label this symbolic exposure as "audio-visual" conjures up the image in some quarters of complicated machines, exotic visuals, and specialized personnel. This would seem to be an unfairly limiting image, since the entire teaching operation is audio-visual, and outcomes of teaching which utilize every means of conceptual clarification are cognitive outcomes.

Clarification is supposedly a function which overlaps both information getting and analysis. Any aids, methods, or modes of presentation which will advance this function should, ipso facto, be given serious consideration by those immediately concerned with the learning process.

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APPENDIX I

GEOGRAPHIC TERMS PRESENTED IN STATE ADOPTED TEXTS IN GEOGRAPHY AND THE SOCIAL STUDIES FOR FOURTH AND FIFTH GRADES IN THE STATE OF OKLAHOMA
JANUARY, 1964

Title	Term	Mode of Presentation: Verbal Definition	Illustration	Diagram
Homelands of the World, Cpr. 1960, Thurston et al Iroquois Co.	basin	x	x	
	bay	x	x	
	beach	x		
	bight	x		
	bore	x		
4th grade geography social studies	canal	x		
	canyon	x		
	cape	x		x
	channel	x		
	coast	x		x
	current	x		
	delta	x		x
	desert	x		
	dike	x	x	
	divide	x		x
	dune	x		
	fiord	x	x	
	forest	x		
	geyser	x	x	
	glacier	x	x	
	gorge	x	x	
	grassland	x	x	x
	gulf	x		x
	harbor	x		x
	highland	x		x
	hill	x		
	island	x		
	isthmus	x		x
	jungle	x		x
	lake	x		x
	lowland	x		x
	marsh	x	x	
	mesa	x	x	
	mountain (pass, range)		x	

APPENDIX I--Continued

Title	Term	Mode of Presentation: Verbal Definition	Illustration	Diagram
Homelands of the World, continued.	oasis	x	x	
	ocean	x		
	peninsula	x		
	plain	x		
	plateau	x		
	polder	x	x	
	prairie	x		x
	reef	x		
	river	x		x
	sea	x		x
	sound	x		
	strait	x		x
	tributary	x		
	valley	x		
	volcano		x	
	waterfall	x	x	
	watershed	x		
	zones	x		
Our Big World, 1961, by Barrows, et al Silver Burdett	ocean	x	x	x
	dike	x	x	
	bay	x	x	x
	mountains	x	x	x
	canals	x	x	
4th grade geography social studies	cape			x
	river		x	
	continent			x
	delta	x		x
	desert	x	x	x
	dunes	x		
	fiords	x		x
	forests	x	x	
	glacier	x		
	grasslands	x	x	
	harbor	x	x	x
	islands	x		x
	isthmus		x	
	lake			x
	lowlands (plains)	x		
	oasis	x	x	
	peninsula	x		x

APPENDIX I--Continued

Title	Term	Mode of Presentation: Verbal Definition	Illustration	Diagram
Our Big World, continued.	polder	x		x
	saeter	x		
	sea coast			x
	valleys		x	
	volcanoes		x	
Many Lands, Cpr. 1961, Borchert, et al Rand McNally and Company 4th grade geography	valley	x		
	mountains			x
	ocean			x
	bay		x	
	cape	x		
	coast line	x	x	
	dams	x	x	
	delta	x	x	
	desert	x	x	
	fiords	x	x	
	forests	x	x	
	glacier	x	x	
	grasslands	x		
	gulf	x		
	harbor	x	x	
	island	x	x	x
	isthmus	x		
	river			x
	oasis	x		
	saeter	x	x	
	tributary	x		x
	tundra	x		
	volcanoes	x		
Neighbors Around the World, Rev. Cpr. 1959 by Smith et al 4th grade geography	canal	x		
	dam	x	x	
	desert	x	x	
	forest	x	x	
	grassland	x		
	iceberg	x	x	
	island	x		x
	jungle	x		
	lake	x		
	mountain	x		

APPENDIX I--Continued

Title	Term	Mode of Presentation: Verbal Definition	Illustration	Diagram
Neighbors Around the World, Continued.	ocean	x		x
	oasis	x		
	sea	x	x	
	strait	x		
	tundra	x	x	
	valley	x		
A Journey Through Many Lands, 1960, Stull, Allyn and Bacon	passes	x		
	peaks	x	x	
	tunnels	x		
	basin	x		x
	source of river	x		
4th grade geography	mouth of river	x		
	farmland	x		x
	hills	x		x
	rain forest	x	x	
	highlands	x		
	coastal plains	x		x
	desert	x		x
	mountains	x	x	x
	savanna	x		x
	peninsula	x		x
	strait	x		x
	lake	x		x
	bay	x		x
	island	x		x
	glacier	x		
	river	x	x	x
	canal			
	swamp	x		x
Your People and Mine, Rev., Cpr. 1960, by Tiegsetal Ginn and Co.	bay	x		x
	branch	x		
	canal	x		x
	canyon	x		x
	channel	x		x
4th grade social studies	cliff	x		x
	climate	x		x
	coast	x		

APPENDIX I--Continued

Title	Term	Mode of Presentation: Verbal Definition	Illustration	Diagram
Your People and Mine, continued.	continent	x		
	current	x		
	dam	x		x
	delta	x		
	desert	x		
	downstream	x		
	falls	x		
	glacier	x		
	gulf	x		
	harbor	x		
	hill	x		x
	island	x		
	lake	x		x
	mesa	x		
	mountain (range)	x		x
	mouth (of a river)	x		
	oceans	x		
	peninsula	x		
	plain	x		
	rapids	x		
	river	x		
	sea	x		
	sources (of a river)	x		
	swamp	x		
In All Our States, 1961, Hanna et al Scott, Foresman & Company 4th grade social studies	island	x	x	x
	bay	x	x	x
	butte	x	x	
	canal	x		
	coastal plain	x		x
	coast ranges	x		x
	river	x		x
	continent	x		x
	continental divide	x		x
	dam	x	x	
	valley	x	x	
	delta	x		x
	desert	x		x

APPENDIX I--Continued

Title	Term	Mode of Presentation: Verbal Definition	Illustration	Diagram
In All Our States, continued.	fall line	x		
	forest	x	x	
	glacier	x	x	
	canyon	x	x	
	plains	x	x	
	gulf	x		x
	harbor	x		x
	highlands	x		x
	channel	x		
	peninsula	x		x
	lake	x	x	x
	levees	x	x	
	lowlands	x		x
	butte	x	x	
	mountain	x	x	x
	ocean	x	x	x
	plain	x	x	x
	plateau	x		x
	prairie	x	x	x
	sound	x		
	river basin	x	x	
	strait	x	x	
	tide	x		
	tributaries	x		x
	tundra	x		
	sea	x	x	x
	strait	x	x	x
	swamps	x		
	waterways	x		
	mouth of the river	x		x
Exploring Near and Far, 1955, Sorenson, et al, Follett Publishing Company; 4th grade social studies	river	x		x
	bay	x		
	canyon	x	x	
	mountains	x	x	x
	channel	x		
	cliff	x		
	rain forest	x		
	coast	x		
	continents	x		x

APPENDIX I--Continued

Title	Term	Mode of Presentation: Verbal Definition	Illustration	Diagram
Exploring Near and Far, continued.	cove	x		
	dams	x	x	
	deserts	x		x
	fiord	x	x	x
	forests	x	x	x
	gulf	x		
	harbor	x		
	highland	x		
	hill	x		
	inland	x		
	island	x	x	x
	lake	x		x
	levee	x		
	lowland	x		
	mouth (of river)	x		
	oasis	x		x
	oceans	x	x	x
	plateau	x	x	
	port	x		x
	prairie	x		
	sand dunes	x	x	
	sea	x		
	seashore	x		
	swamp	x		
	tides	x	x	
	valley	x		
Living Together Around the World, 1958, Cutright, et al, The MacMillan Co. 4th grade social studies	river		x	x
	bays	x		x
	continents	x		x
	delta	x		x
	desert	x	x	x
	forest		x	
	glaciers	x		
	gulfs	x		x
	strait	x		
	oasis	x	x	
	plains	x	x	x
	plateaus	x		x
	ports	x		x
	rain forests	x	x	

APPENDIX I--Continued

Title	Term	Mode of Presentation: Verbal Definition	Illustration	Diagram
Living Together Around the World, continued.	river	x	x	x
	seaport	x		x
	strait	x		x
	tree line	x		
	tributaries	x		x
	harbor	x		
	highlands	x		x
	island	x		x
	lowlands	x		x
	valley			x
Your Country and Mine, Rev., Cpr. 1960, by Tiegs, et al, Ginn & Company 5th grade geography	bay	x		x
	branch	x		x
	canyon	x		x
	cape	x		x
	cliff	x		x
	continents	x		x
	current	x		x
	delta	x		x
	divide	x		x
	downstream	x		x
	falls	x		x
	fiord	x		x
	glacier	x		x
	gulf	x		x
	harbor	x		x
	hemisphere	x		x
	highlands	x		x
	hill	x		x
	iceberg	x		x
	island	x		x
	isthmus	x		x
	jungle	x		x
	lake	x		x
	mountain	x		x
	mouth (of a river)	x		x
	oceans	x		x
	pampas	x		x
	peninsula	x		x
	plain	x		x

APPENDIX I--Continued

Title	Term	Mode of Presentation		
		Verbal Definition	Illustration	Diagram
Your Country and Mine, continued.	plateau	x		x
	port	x		x
	prairie	x		x
	river (basin valley)	x		x
	sea	x		x
	sound	x		x
	source (of a river)	x		x
	strait	x		x
	tundra	x		x
	valley	x		x
	volcano	x		x
Neighbors of the Americas, Rev., Cpr. 1957, by Smith, et al Holt Rinehart, Winston	antiplano	x		
	basin	x		
	bay	x		
	canal	x	x	
	canyons	x	x	
	cape	x		
	coastalplain	x		
5th grade geography	dams	x		
	delta	x		
	desert	x	x	
	divide	x		
	glacier	x	x	
	harbor	x		x
	island	x	x	x
	isthmus	x		
	jungle	x	x	
	mesa	x		
	peninsula	x		
	plateau	x		
	ports	x		
	prairies	x		
	selvas	x		
	sound	x		
	strait	x		
	tundra	x	x	
	valley	x		
	volcanoes	x		

APPENDIX I--Continued

Title	Term	Mode of Presentation: Verbal Definition	Illustration	Diagram
Homelands of the Americas, Cpr. 1960, by Thurston et al Iroquois Publishing Company 5th grade geography	archipelago	x		
	bay	x		
	canals	x		
	canyon	x		
	cape	x		
	coastal plain (coastal range)	x		x
	dam	x		
	delta	x		
	desert	x		
	divide	x		
	escarpment	x		
	estuary	x		
	fiords	x	x	
	flood plain	x		
	forests	x		
	geysers	x		
	grasslands	x	x	x
	iceberg	x		
	jungles	x	x	
	levee	x		
	mountain		x	x
	ocean			x
	pass	x		
	plateau	x		x
	pampas	x		
	river			
	sound	x		
	strait	x		x
	tundra	x		
	valley	x		
	volcanoes	x		

APPENDIX I--Continued

Title	Term	Mode of Presentation: Verbal Definition	Illustration	Diagram
Journeys Through the Americas, Cpr. 1960, by Stull et al Allyn and Bacon, Inc.	basin	x		
	bayou	x		
	coastal region	x		
	coast	x		
	canyon	x		
	canal	x	x	
	causeway	x		
5th grade geography	continent	x		
	dam	x		
	delta	x		
	desert	x		
	divide	x		
	estuary	x		
	gulf	x		
	glacier	x		
	ice fields	x		
	island	x		
	isthmus	x		
	lakes	x	x	x
	levee	x		
	mountain	x		
	pampa	x		
	peninsula	x		
	piedmont	x		
	plain	x		
	plateau	x		
	prairie	x		
	river	x		
	sound	x	x	x
	strait	x	x	x
	savanna	x		
	source (river)	x	x	x
	valley	x	x	

APPENDIX I--Continued

Title	Term	Mode of Presentation: Verbal Definition	Illustration	Diagram
The American Continents, Cpr. 1961, Barrows et al, Silver Burdett Company. 5th grade geography	canal	x		
	canyon	x		
	Cape	x		
	coast range	x		
	dams	x	x	
	desert	x		
	forest	x	x	x
	glacier	x		
	grassland	x	x	
	lakes	x		x
	lowlands	x		
	islands	x		x
	oasis	x	x	
	plains	x		
	sea	x		
	sounds	x		
	tundra	x		
	pampa	x		
Geography of the New World, 1961, Borchert et al, Rand McNally & Company. 5th grade geography	mountains	x	x	
	peninsula	x	x	
	islands	x	x	x
	river	x	x	x
	valley	x	x	x
	desert	x	x	x
	lake	x	x	x
	ocean	x	x	x
	bayou	x	x	
	canyon	x	x	
	valley	x	x	x
	bottom lands	x	x	
	sea	x	x	x
	coastal plain	x	x	x
	coast mountains	x		x
	coast ranges	x		x
	delta	x		x
	desert (see above)			
	canal	x	x	x
	flatlands	x	x	x
	flatwoods	x	x	

APPENDIX I--<u>Continued</u>

Title	Term	Verbal Definition	Illustration	Diagram
		Mode of Presentation		
Geography of the New World, Continued.	forest regions	x	x	
	grassland (pampas prairies)	x	x	x
	pampas	x		
	prairies	x	x	x
	icecaps	x		
	levee	x		
	plateau	x	x	
	falls	x	x	
	rain forest	x	x	
	savannas	x	x	
	swamps	x	x	
	tundra	x	x	
	marshes	x		
	strait	x	x	
	isthmus	x		x
Exploring the New World, 1958, Hamer et al, Follett Publishing Company	river	x	x	x
	lowlands	x		x
	mountains	x	x	x
	ocean	x	x	x
	coastal plain			
5th grade social studies	bays	x		x
	sea	x		x
	strait	x		x
	valleys	x		x
	canal	x		x
	canyon	x		x
	cape	x		x
	plains	x		x
	coast range	x		x
	plateau	x		x
	gap	x		x
	delta	x		x
	desert	x	x	x
	divide	x		x
	glacier	x	x	x
	gulf	x		x
	harbor	x		x
	hill	x		x
	iceberg	x		x

APPENDIX I--Continued

Title	Term	Mode of Presentation: Verbal Definition	Illustration	Diagram
Exploring the New World, continued.	island	x		x
	isthmus	x		x
	lake	x		x
	mouth	x		x
	port	x		x
	basin	x		x
	sound	x		x
	strait	x		x
	swamp	x	x	x
	tributary	x		x
	volcano	x	x	x
Living Together in the Americas, 1958, Cutright et al, The Macmillan Company 5th grade social studies	altiplano	x		
	basin	x		
	campos	x		
	canal	x	x	x
	coastal plain	x		
	continental divide	x		
	continental shelf	x		
	crater	x		
	estuary	x		
	flood plain	x		
	gap	x		
	geyser	x		
	isthmus	x		
	levee	x		
	mainland	x		
	mesa	x		
	pampas	x		
	peninsula	x		
	piedmont	x		x
	polar region	x		
	prairie	x	x	x
	selvas	x	x	
	sound	x		
	tidewater region	x		
	tropics	x		
	tundra	x	x	
	uplands	x		
	volcano	x		
	canyon	x	x	
	glacier	x		

APPENDIX I--Continued

Title	Term	Mode of Presentation: Verbal Definition	Illustration	Diagram
Within Our Borders, 1961, Jones et al, Rand, McNally Co.	sound		x	
	plateau			
	river		x	
	valley			
5th grade social studies	coast		x	
	beaches		x	x
	strait			
	border	x	x	
	canyon		x	
	canal	x		
	cape		x	
	bay		x	
	highlands			
	coastal plain			
	coast range		x	
	basin	x		
	gap	x	x	
	dam		x	
	desert		x	
	divide			
	fall line		x	
	forests		x	x
	geysers	x		
	grasslands	x	x	
	island		x	x
	lowlands		x	
	mountains		x	x
	passes	x		
	piedmont	x	x	
	plains	x	x	

APPENDIX II

Name____________________

GEOGRAPHICAL WORDS

Part One

Directions: The terms below describe certain features found on the earth's surface. Please circle the one term that best fits the feature indicated by your instructor. The terms will be read aloud to you as you are reading them silently. The feature will then be pointed out to you on the screen and you will be asked to make a choice.

Sample:	mountain	foothill	crag	precipice
1.	basin	bay	harbor	levee
2.	coast	bay	lake	inlet
3.	canal	tributary	channel	sound
4.	tunnel	divide	canyon	crater
5.	peninsula	island	cape	isthmus
6.	tributary	branch	canal	channel
7.	mesa	cliff	plateau	butte
8.	coast	sea level	beach	bay
9.	continent	island	coastline	shelf
10.	divide	delta	estuary	sound
11.	dune	oasis	desert	sandbar
12.	rapids	hill	estuary	dike
13.	canyon	divide	valley	fiord
14.	gulf	port	inlet	sound
15.	channel	harbor	peninsula	cape
16.	rain forest	highland	valley	tundra

APPENDIX II--Continued

17.	hill	volcano	crater	foothill
18.	reef	isthmus	island	peninsula
19.	swamp	isthmus	strait	marsh
20.	branch	lake	stream	port
21.	mesa	plateau	lowland	butte
22.	mountain	foothill	hill	volcano
23.	lake	bay	ocean	sea
24.	delta	peninsula	island	reef
25.	plain	marsh	summit	hill
26.	oasis	plateau	foothill	basin
27.	desert	oasis	prairie	dune
28.	jungle	rain forest	swamp	marsh
29.	source (river)	river	brook	creek
30.	lake	ocean	harbor	sea
31.	canal	divide	sound	fiord
32.	mouth (river)	source (river)	upstream	downstream
33.	isthmus	reef	canal	strait

Part Two

34. ______________________________

35. ______________________________

36. ______________________________

37. ______________________________

APPENDIX II--<u>Continued</u>

38. ______________________________

39. ______________________________

40. ______________________________

41. ______________________________

42. ______________________________

43. ______________________________

44. ______________________________

45. ______________________________

46. ______________________________

47. ______________________________

48. ______________________________

49. ______________________________

50. ______________________________

51. ______________________________

52. ______________________________

APPENDIX III

Part Two Questions
(Example)

In the last two orbital flights made by American astronauts, one of the high points of their experience seemed to be that of looking down at the earth's surface and seeing oceans, rivers, and mountain ranges which they had seen before only on maps and globes. Their capsules were well equipped with fine cameras that photographed large portions of the earth's surface; some of you may have seen these pictures in magazines you have read.

As you know, it probably will not be too long before the Gemini flight will be launched and two men will orbit the earth in one spacecraft. I am going to ask you to imagine that you are technicians sitting in the control room at Cape Kennedy, recording the information that is being sent back to earth. I shall be relaying this information to you in the form of descriptions of features which can be seen through the telescopic sights built into the capsule. Imagine, if you will, that these telescopes are capable of such magnification that Gemini passengers would be able to identify this school from among the other buildings in this block.

As I describe each geographical feature to you, please write the name you would give to it in the spaces provided under the words, Part Two. I will give you the number by which you should write the word or words each time I give you a description. Number thirty-four is a practice space. For example, I might tell you that I see something that looks like a mountain, but it seems to have smoke rising from it. What word would one write to match this description? Yes, one would answer, "volcano". Spelling the word in exactly the right way is not as important now as using the best word to match the description.

PART TWO

Oral Questions

35. (glacier) We are now looking down on a mass of ice which seems to fit in the valley in which it lies. This mass of ice is shaped a little like a tongue. It must be moving slowly because we can see rock material which has been deposited along the course where it has been. What is it?

36. (iceberg) Here is another mass of ice, but it is floating in the sea. It does not seem to be attached to anything. What is it?

37. (fiord) The familiar coastal outline below tells us we are over the Scandinavian countries, and as we look down we see many long, narrow inlets into the sea-coast. These inlets seem to have more or less steep sides. What are these inlets called?

APPENDIX III--Continued

38. (tundra) We are still in the northern hemisphere, and the ground below looks as if there are a few small plants on it. There are no trees and it must be very cold most of the year. This might be a description of a mountain peak, but strangely enough, these are treeless plains. Can you think of the name we call them?

39. (forest) Just south of these cold treeless plains we see a large area of land covered with trees. This is a ________.

40. (dune) On our next orbit, we seem to be passing over a hot desert. Below, sand particles are being carried along by the wind and piled into a heap. It looks like a small ridge or hill. What is it?

41. (oasis) In the midst of the desert below, there is a small clump of palm-trees. Trees need water to live. What is the name of this fertile area?

42. (savanna) Below us is a region which is close to the hot desert. It has grass and scattered trees. Part of the year it is very wet, and part of the year it is very dry. What is another name for this tropical grassland?

43. (jungle) There is a wild looking, uncultivated land with a dense undergrowth. It must be a ______________.

44. (Pampas or steppes) Plains are given different names when they are found in different parts of the world.

APPENDIX III--Continued

Some of the plains we have passed over were in South America. What are they called? If you have trouble remembering that name, perhaps you can remember what they are called in the U. S. S. R. If you know both these names, write them on line forty-four.

45. (swamp) Here is an area of low-lying land which looks as if it is too saturated with moisture to be good for farming. There are some trees and coarse grasses growing on it. What is it?

46. (marsh) There is more low-lying land but it is a little different since it seems to be completely under water. What would you call it?

47. (levee) There is an embankment beside the river below us which looks as if it is higher than the adjoining country. It has been formed during the times when the river flooded, but now it appears to prevent the river from overflowing. What should be call this embankment? A tip: the answer is not "a bank".

48. (dike) We can see a bank of earth and stones which must have been constructed to prevent low-lying land from being covered by the river. It must be a _____________.

49. (seaport or port) There is a town, or perhaps it is a city which has a harbor at which ships call to load and unload goods. This town or city is called a ___________.

APPENDIX III--Continued

50. (dam) There is a bank or wall which is holding back water to form a lake. It probably supplies the surrounding country with water for irrigation. It could be that they manufacture electricity here. What is this bank or wall which is holding back the water called?

51. (geyser) We are completing our final orbit and we are nearing home. We are passing over a spot where many Americans enjoy vacationing. There is a hot spring which throws a jet of hot water and steam into the air. What do we call hot springs such as this one?

52. (waterfall) There is a stream of water dropping over a precipice. What is it called?

APPENDIX IV

ITEM ANALYSIS

Item	Number of Times Missed
basin	23
bay	30
canal	25
canyon	18
cape	34
channel	20
cliff	21
coast	9
continent	8
delta	22
desert	8
dike	5
divide	38
gulf	39
harbor	22
valley	23
foothill	10
island	8
isthmus	34
lake	12
lowland	11
mountain	9
ocean	1
peninsula	6
plain	10
plateau	17
prairie	7
marsh	19
river	1
sea	21
sound	35
source (river)	28
strait	22
volcano	0
iceberg	12
glacier	22
fiords	45
tundra	52
forest	10
dune	14
oasis	9
jungle	9
swamp	20

APPENDIX IV--Continued

Item	Number of Times Missed
savanna	53
port or seaport	33
pampas-steppes	53
levees	34
mesa	30
dam	7
pass or gap	35
geyser	17
falls or waterfalls	14

APPENDIX V

GEOGRAPHICAL TERMS

Basin - - - - - 1) A low place in the surface of the land, usually with a body of water occuping the lowest part.
2) The entire area drained by a river system.

Bay - - - - - - 1) An inlet of the ocean or part of the ocean bordering on land and partly surrounded by land.
2) Any small body of water set off from the main body of an ocean, lake, or gulf.

Beach - - - - - The pebbly or sandy shore of the sea or of a lake which is washed by the waves.

Canal - - - - - A man-made channel filled with water used for navigation, irrigation, or drainage.

Canyon- - - - - A deep, narrow valley having high, steep slopes.

Cape- - - - - - A narrow piece of land projecting into the sea.

Channel - - - - 1) A narrow strip of water.
2) The part of a stream or body of water which affords the best passage for vessels; usually because of its greater depth.

Cliff - - - - - The steep, rocky face of a bluff.

Coast - - - - - Land along the sea, bay, gulf, lake, or ocean.

Continent - - - Any one of the seven largest areas of land on the Earth's surface.

Crag- - - - - - A projecting point of rock, usually perpendicular or nearly so.

Dam - - - - - - A bank or wall built across a stream to hold back water.

Delta - - - - - Earth that is dropped by running water when a stream flows into the still water of a lake or ocean.

APPENDIX V--Continued

Desert- - - - - A large area of land with little or no moisture, vegetation, or life.

Dike- - - - - - Earth or other material built up along a river or ocean to keep the water from overflowing onto the land.

Divide- - - - - A water parting or watershed which separates two drainage areas.

Downstream- - - The direction in which a stream is flowing.

Drainage Basin- The area from which a single stream or river and its tributaries drains all of the water; the "drowned mouth of a river".

Dune- - - - - - A hill or ridge of sand piled up by the wind.

Estuary - - - - A narrow arm of the sea at the mouth of a river where the ocean tide meets the river current.

Fiord - - - - - A deep, narrow inlet of the sea, that has been gouged out by a glacier.

Foothill- - - - A hill at the base of a mountain.

Forest- - - - - A large area of land covered with trees.

Glacier - - - - A large moving sheet or stream of ice formed in an area, usually at high elevations, where the temperature remains below or near freezing and more snow accumulates in winter than melts in summer.

Gulf- - - - - - An area of water bordering on, and lying within a curved coastline; usually larger than a bay and smaller than a sea; sometimes nearly surrounded by land.

Harbor- - - - - A sheltered body of water where ships anchor and are protected from storms.

Hill- - - - - - A small area of land that is higher than the land around it, that is less than 2,000 feet from base to summit.

APPENDIX V--Continued

<u>Iceberg</u> - - - - A huge block of floating ice broken from a glacier; found in the most northerly and southerly areas of the world's oceans.

<u>Inlet</u> - - - - - A recess in a shore; a narrow strip of water running into the land or between islands; a creek.

<u>Island</u>- - - - - An area of land surrounded by water.

<u>Isthmus</u> - - - - A narrow piece of land joinging two larger bodies of land, or joining a peninsula with a mainland.

<u>Lake</u>- - - - - - An inland body of water usually of considerable size.

<u>Levee</u> - - - - - An embankment beside a stream which prevents overflow.

<u>Marsh</u> - - - - - An area of low, wet, poorly drained land.

<u>Mesa</u>- - - - - - A flat topped, rocky hill with steeply sloping sides.

<u>Mountain</u>- - - - A lofty elevation on the earth's surface more than 2,000 feet above base.

<u>Oasis</u> - - - - - A fertile spot within a desert, watered by underground springs or by irrigation.

<u>Ocean</u> - - - - - Any one, or all, of the four largest connecting bodies of salt water on the earth's surface.

<u>Pass</u>- - - - - - An opening through hills or mountains used as a route for highways or railroads.

<u>Peninsula</u> - - - A piece of land nearly surrounded by water and attached to a larger area of land or the mainland by an isthmus.

<u>Plain</u> - - - - - A nearly level area of land usually of considerable size.

<u>Plateau</u> - - - - A large, level, or nearly level area of elevated land with a steep approach on at least one side.

APPENDIX V--Continued

Prairie - - - - Any natural grassland; but usually used to describe the vast areas of level or rolling land without trees in the central part of the United States.

Precipice - - - A very steep, high cliff.

River - - - - - A large stream of water of natural origin, which drains an area of land and flows into another river or body of water.

River Mouth - - The point where a river empties and ends its course.

River Source- - The point where a river begins.

Sandbar - - - - A long, narrow bank of sand in a body of water.

Sea - - - - - - 1) A large body of water partly or nearly surrounded by land.
2) Sometimes used to describe all the ocean area of the world as a unit.

Seaport - - - - 1) A harbor at the shore of the ocean or large body of water developed with facilities to load and unload sea-going vessels.
2) A city or town built at this point.

Sound - - - - - A long and rather narrow body of water, larger than a strait, connecting two large bodies of water or separating a large island from the mainland.

Strait- - - - - A passageway of water connecting two large bodies of water.

Swamp - - - - - An area of low spongy land too wet to farm but usually supporting an abundance of coarse grasses, trees, or other vegetation.

Tributary - - - A stream which flows into another stream; usually used to describe the one which considerably increases the size of the stream into which it flows.

Upstream- - - - Direction from which a stream is flowing.

APPENDIX V--Continued

Valley- - - - - The land between hills or mountains, sometimes containing a stream.

Volcano - - - - A cone-shaped mountain formed by lava and cinders, erupted through a crater; an opening in the earth's surface from which flows or has flown molten rock, steam, cinders, gas, and rock fragments. An active volcano is one which is pouring forth any or all of these materials. A dormant volcano is one which temporarily has ceased such eruptions.

Waterfall - - - A stream of water dropping over a dam or precipice.

TABLE 10

SUMS OF SQUARES AND SUMS OF PRODUCTS

Photographs			Verbal Definitions			Film Strips			Diagrammatic Transparencies			Three Dimensional Models		
I			II			III			IV			V		
X^2	xy	Y^2	X^2	xy	Y^2	X^2	xy	Y^2	X^2	xy	Y^2	X^2	xy	Y^2
1764	1680	1600	2116	2162	2209	676	936	1296	576	1080	2025	1089	1151	2209
961	1240	1600	1369	1739	2209	841	1131	1521	1764	1974	2209	729	999	1369
1521	1599	1681	1156	1394	1681	961	1395	2025	484	770	1225	961	1364	1936
1156	1598	2209	2116	2116	2116	1764	1890	2025	1225	1610	2116	841	1131	1521
961	1302	1764	1225	1435	1681	900	1260	1764	841	1102	1444	841	1160	1600
1089	1089	1089	1600	1720	1849	784	1008	1296	784	940	1225	1024	1120	1225
961	1457	2209	1849	2021	2209	900	1170	1521	1225	1365	1521	1521	1833	2209
1369	1369	1369	1681	1886	2116	900	1320	1936	576	1056	1936	1600	1640	2116
1444	1748	2116	1296	1692	2209	361	798	1764	1369	1702	2116	841	1189	1681
1296	1692	2209	1225	1610	2116	625	900	1296	676	1196	2116	1369	1702	2116
1681	2050	2500	1600	1520	1444	1156	1292	1444	1225	1540	1936	625	1200	2304
1369	1739	2209	1156	1496	1936	1521	1794	2116	1225	1645	2209	841	1276	1936
841	1334	2116	1089	1518	2116	784	924	1089	676	988	1444	1600	2000	2500
1296	1800	2500	1444	1710	2025	900	1170	1521	1369	1739	1369	841	996	1156
1156	1530	2025	1444	1710	2025	576	720	900	784	1204	1849	1156	1632	2304
1521	1638	1764	1089	1551	2209	784	1120	1600	784	1148	2025	484	814	1369
TOTALS:														
20386	24865	30960	23455	27280	32150	14433	18828	25114	15583	21059	28765	16363	21207	29551

$X^2 = 90220$ $Y^2 = 146540$ $xy = 113239$

X^2 -- Geographic terms pretest score squared

Y^2 -- Geographic terms posttest score squared

xy -- Cross product of deviation