THE RELATIONSHIP OF COGNITIVE STYLE AND METHOD OF INSTRUCTION TO PERFORMANCE IN GRADE NINE GEOGRAPHY

by

TARRANCE DON GRIEVE

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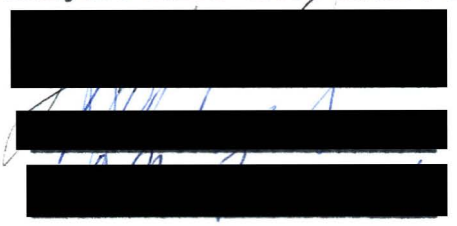
ABSTRACT

The learning performance of 117 Grade Nine geography students was studied as a function of task presentation and cognitive style. A discovery and an expository instructional method were operationally defined in terms of the sequence with which instruction was given, and Cognitive Style was defined in terms of an individual's performance on the Hidden Figures Test. The learning task involved the acquisition of knowledge of the geography of Japan and the acquisition of the ability to handle geographic materials similar to those used in the Japan unit. Experimental Ss were presented with 11 hours of instruction through typical geographic materials and activities introduced by two teachers trained in both discovery and expository sequencing. Separate 2 x 2 analyses of the data revealed a significant main effect of Cognitive Style for males and females but the main effect of Method was not reliable. Identical results were obtained for extreme global and analytic females. For extreme global and analytic males the main effects were not reliable but the Cognitive Style and Method interaction was. This interaction indicated that global males experience difficulty under an expository method and that under a discovery method their performance is not significantly different from that of analytic males under either method.

Examiners:



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CHAPTER I

STATEMENT OF PROBLEM AND REVIEW OF RELEVANT LITERATURE

To achieve maximally efficient learning in the classroom is a major goal of educators. Towards this end, several investigators have sought to determine the relative efficacy of two differential methods of instruction or task presentation which have generally been referred to as discovery and expository methods. Proponents of the discovery method have argued for its superiority as a method of teaching and claim that discovery techniques enhance retention and transfer of knowledge as well as student motivation (Beberman, 1958; Bruner, 1960). Critics of the discovery method discount it as pedagogically impractical, especially with respect to rate of learning, and argue that discovery techniques offer little to the learner that cannot be offered equally well by good expository methods (Ausubel, 1961, 1964).

Apparent support for each of these positions is available in the research literature. For example, Craig (1956), Kittell (1957), and Kersh (1962) found that expository task presentation produced significantly better results on retention and transfer measures than did discovery methods. Investigations by Swenson (1949) and Ray (1961), however, indicated just the opposite. Further, comparative studies by Hendrix (1947) and Gagné and Brown (1961) indicate that discovery techniques are more effective than

expository techniques in terms of transfer of learning but investigations by Craig (1953) and Corman (1957) support expository methods on transfer tests.

One of the greatest factors contributing to such equivocal research evidence seems to be semantic inconsistency. Wittrock (1966) pointed out in his review of literature on discovery learning that researchers have yet to agree as to what they mean by such terms as discovery, guided-discovery, and exposition. Many investigators have been primarily concerned with the role of verbalization in discovery-expository processes, while others have directed their attention to the amount and type of external guidance to which the learner is subjected. Still other researchers have focused on feedback mechanisms or on presentation rates. Until the terms discovery and expository have been reduced to generally accepted operational definitions, it is highly improbable that results of the many investigations will be comparable. Wittrock (1966) also indicated that, "treatments should be designed to vary one element at a time. If an experiment is performed, its treatments should differ from one another in a meaningful way (p. 70)." Towards this end, Worthen (1968) described and compared a discovery method with an expository method for teaching elementary mathematics. The methods as defined by Worthen differed only in terms of the sequence characteristics of the task presentations. The expository treatment was found to be superior in terms of initial learning, while the

discovery treatment proved to be superior on retention and transfer tests. It seems, therefore, that the sequence variable sufficiently differentiated the two instructional methods for elementary mathematics. The aspect of sequence of task presentation, however, has yet to be looked at with respect to other subject matter areas.

A second source of noncomparable results stems from the fact that most studies comparing expository and discovery task presentations have been conducted in a laboratory and have dealt with small numbers of subjects, small time samples, and very specific learning tasks. To generalize the findings of such investigations to classroom learning or instructional procedures is open to serious question. Cronbach (1966) states that, "unless learning tasks are comparable to those of the classroom, they are unserviceable as a basis for educational recommendations(p. 77)." It would seem, therefore, that the findings of a carefully controlled classroom experiment (in which both learning task and time sample are typical of those of the classroom setting) could be generalized with greater confidence than could the results of the laboratory-type experiment.[1]

A third factor contributing to contradictory findings is the failure of investigators to consider individual difference variables

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[1]The difficulty of controlling research in a classroom setting has been documented (Williams, 1965) and is acknowledged by the present investigator. It would seem, however, that this difficulty should not prevent attempts to use the classroom as a research setting.

in their research. It is possible that the method versus method issue is not truly meaningful. As Cronbach (1966) postulates,

> Discovery surely has more value for some pupils than for others. We should expect an interaction between the discovery variable and pupil characteristics, such that among pupils classified at the same level some respond better to inductive teaching and some better to didactic teaching...Ultimately, enough knowledge should permit us to say that a fourth-grader with one profile of attainment needs discovery experience, whereas another will move ahead more rapidly if teaching is didactic (pp. 90-91).

Similar statements are made by Wittrock (1966), Ausubel (1963), and Schulman and Keislar (1966) in their reviews of the comparative studies involving a discovery approach. It would seem, therefore, that investigators should turn their attention to studies designed to determine the relationship between differential task presentations and individual difference variables of the learners.

The present study had three major purposes, each related to one of the above sources of equivocacy. One aim was to operationally define and compare an expository method and a discovery method which differed primarily in terms of the sequence characteristics of the task presentations. In this regard, the present study was similar to Worthen's (1968), but whereas this study concerned differential task presentations in elementary mathematics, this study concerned two differential task presentations in Grade Nine geography.

A second purpose of the present study was to compare the two instructional methods in a setting where the learning tasks and

time sample approximated typical classroom conditions. Accordingly, a secondary geography unit on Japan was selected as content for the two differing instructional sequences. These sequences were presented to the subjects (Ss) through instructional materials typical of geography (photographs, maps, statistics, prose) introduced into the classroom by two teachers trained in both experimental methods. Total instructional time under each task presentation was eleven hours which approximated one month of regular social studies classes.

The third major purpose of the present study was to determine the relationship between the individual difference variable cognitive style and two methods of instruction. Although cognitive style has received a good deal of experimental attention, its relationship to learning performance in the classroom and its interaction with instructional methods has yet to be determined. Results of several laboratory studies concerned with cognitive style suggested that performance in discrimination, paired-associate, and serial learning tasks is influenced by a person's cognitive style (Guetzkow, 1951; Baggaley, 1955; Gardner & Long, 1961). Furthermore, a study by Davis (1967) revealed that high school males with an analytic cognitive style performed better in a standard concept identification task than did high school males with a non-analytic cognitive style.

As defined by Davis (1967) and as used in this study, cognitive style is "concerned primarily with the manner in which the individual perceives and analyzes a complex stimulus configuration (p. 1)". The extremes of this dimension are exemplified by subjects (Ss) who are able to "analyze and differentiate the components of the stimulus complex and by Ss who fail to analyze and differentiate the components and respond to the 'stimulus as a whole' (p. 1)." The former Ss are termed analytic and the latter Ss are termed global or non-analytic. The operational definition of an individual's cognitive style as used in this study was in terms of performance on the Hidden Figures Test (HFT), one of the reference tests for cognitive factors presented by French, Ekstrom, and Price (1963). Analytic Ss were defined as those Ss who obtained a score on the HFT above the median, and global Ss were defined as those Ss who obtained a score below the median.

In conclusion, it was hypothesised that by varying the instructional methods and cognitive style in a systematic manner, the effects of these two variables could be detected separately and collectively. The major purposes of the present study were to determine the relative efficacy of two task presentations differing primarily in terms of sequence characteristics and to determine whether an individual's cognitive style differentially influenced his performance in a typical geography learning situation. The contradictory results of studies relevant to the instructional

method variable and the lack of studies relevant to the cognitive style variable in the classroom setting warranted the adoption of an enquiry approach rather than an attempt to make and test predictions. The specific questions considered in the present study, therefore, were:

1. In what manner does the sequence of task presentation in a geography learning situation influence the performance of (a) male Grade Nine students? (b) female Grade Nine students?

2. In what manner is an individual's cognitive style, as identified by the Hidden Figures Test, related to performance in a geography learning situation for (a) male Grade Nine students? (b) female Grade Nine students?

3. In what manner does the sequence of task presentation in a geography learning situation influence the performance of individuals who manifest different cognitive styles, as identified by the Hidden Figures Test (a) for males? (b) for females?

CHAPTER II

METHOD

This chapter concerns five major areas: the selection and assignment of subjects, a description of the instructional material, a description of the testing instruments, a description of the instructional procedures followed, a description of the experimental procedures and a discussion of the experimental design.

Subjects

The Hidden Figures Test (HFT) was administered to 227 Grade Nine students in two schools, one month before commencement of the study. This test required that the subjects (Ss) identify one of five simple geometric figures which was embedded in a complex pattern. The test was a group test and consisted of two parts, each part containing 16 complex patterns in which the simple geometric figure to be found was always right side up and the same size as the example figure. A total of 15 minutes for each of the two parts was allowed. The distribution of scores corrected for guessing, is presented in Figure 1.

This distribution may be conceived as a dimension of analytic responding in which the higher scores reflect an analytic cognitive style while the lower scores reflect a global or non-analytic cognitive style.

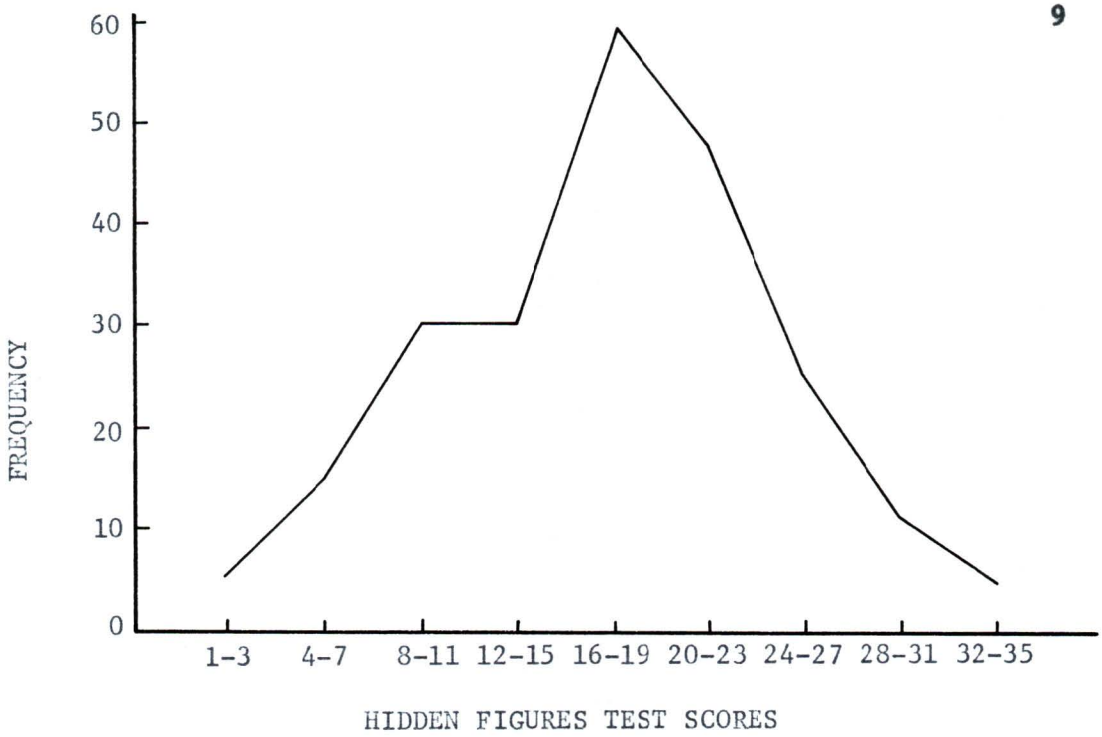

Fig. 1. Distribution of Hidden Figures Test Scores For Grade Nine

Scores for males and females were examined separately, and then compared to determine whether or not there existed a sex difference with respect to the cognitive style variable. Davis (1967) in his review of the literature concerning cognitive style reported that males tended to be more analytical than females. It was expected, therefore, that males would score significantly higher on the HFT than would females. Data for the 227 Grade Nine students are presented in Table 1. A comparison of the means of the female and male groups was made and the expected difference was found ($t = 2.44$; $df = 225$; $p < .05$). This finding was interpreted as support for the decision to analyze the subsequent learning performance of males and females separately.

TABLE 1

Mean Scores on the Hidden Figures Test

Group	N	Mean	SD	Range
All Students	227	18.49	6.64	1.50 - 35.00
Females	97	16.79	6.80	1.50 - 35.00
Males	130	18.99	6.57	7.00 - 35.00

A median split (M = 18.75) was used to identify the analytic and global Ss. Analytic Ss were those scoring above the median and global Ss were those scoring below the median. Of the 227 students tested, 118 (63 in School A and 55 in School B) were randomly assigned to four classes (two per school). Assignment was made with the restriction that each of the classes would contain nearly equal proportions of analytic and global males and females. The two classes in each school were then randomly assigned to the two differing treatments within schools. Data summarizing the experimental groups are presented in Table 2.

TABLE 2

Mean Scores on the Hidden Figures Test for Experimental Groups

Group	N	Mean	Range
Discovery Treatment			
School A	31	17.76	8.50 - 31.25
School B	28	18.03	1.50 - 35.00
Expository Treatment			
School A	32	18.02	3.00 - 32.25
School B	27	18.63	1.75 - 35.00

To provide baseline data against which to assess effects of the two experimental treatments, a control group of 41 students in two intact Grade Nine classes (a class of 16 from School A and a class of 25 from School B) was formed. This group received both the pre- and post-tests but received no special instruction during the intervening period.

In summary, the Ss were 159 Grade Nine students attending two junior high schools in the Greater Victoria area. The experimental group consisted of 118 Ss randomly assigned to four classes (two in each school) on the basis of their HFT performance.[1] The control group consisted of 41 Ss divided among two intact classes (one in each school).

[1] As one S moved during the first few weeks of this study, all subsequent data are based on 117 experimental Ss and 41 control Ss (a total of 158).

Materials

Instructional materials. The unit presented to the experimental Ss was a regional geography unit on Japan which was prepared and given limited field testing in two Victoria junior high schools in the school year 1967-68 (High School Geography Project Team, 1968). The Japan unit consisted of geographic materials (maps, photographs, slides, statistics, and prose passages) that permitted a detailed study of Japan's development from an agricultural economy to an industrial economy. These materials were organized into six activities, each designed to develop generalizations central to the effect of modernization on population and economic patterns.

As used in this study, the term generalization is defined as any statement that expresses a relationship or relationships between elements of a single case(s) and that can be extended with a high degree of certainty (little or no loss of accuracy) to elements of other like cases not considered when the generalization was formed. For example, given the specific case elements of population figures for Japan at five-year periods and percentages of persons suffering from famine for the same time periods, and indexes of support capacity for the same time periods, the following relationship or generalization might be formed: when an increase in population is not accompanied by an increase in support capacity, the number of people suffering from famine increases. Admittedly, such can be expressed in other ways, but the relation-

ship that is descriptive of the single case (Japan) has been extended to all other like cases (any instance of increasing population, stable support capacity, and increasing famine level). Note also that given two of the elements subsequent to the formation of the generalization, the third can be inferred if the relationship holds true. Subsequent evidence might result in a modification of the generalization but such is not relevant to the definition as used in this study.

For the presentation of the Japan Unit, two teacher guidebooks were written by the experimenter.[2] Each guidebook was adapted from the High School Geography Project Team Guidebook and contained behaviorally stated objectives for each of the six activities and guidelines for the teacher to follow. One of the guidebooks was designed to be consistent with the expository method of instruction and the other guidebook was designed to be consistent with the discovery method. Three judges (a senior geography student, and two geography curriculum and instruction professors) independently confirmed that the guidebooks adhered to their respective instructional method and also that the guidelines were suitable with respect to developing the stated behavioral objectives. The three judges also verified that the instructional procedures or

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[2]Copies of these guidebooks are on file with the Educational Research Institute of British Columbia, Board of Trade Tower, 1177 West Hastings Street, Vancouver 1, B.C., Canada.

methods were indeed different.

Five considerations led to the choice of the Japan Unit. First, the unit did not depart from the regular grade nine social studies curriculum, a condition imposed upon the experimenter before permission to use the schools was granted by the district superintendents concerned. Second, as this would be their first formal examination of the geography of Japan, the content of the unit would be equally unfamiliar to all experimental Ss. Third, the unit required 11 hours of instruction which complied with what Cronbach (1966) recommended as being sufficient for a treatment effect to operate where differences between treatments are maximized. Fourth, the unit approximated typical size and time characteristics of junior high school social studies units and could be introduced without upsetting the normal routines of the schools. Finally, the materials of the unit were easily adaptable to both of the experimental treatments and were organized in a manner that permitted telling the Ss that the purpose of the study was to determine the effectiveness of materials organized around specific activities.

Testing instruments. Two testing instruments, which may be found in Appendix E, were used in the present study. Both were used first, as pretest instruments to establish comparability of the experimental groups before treatment, and second, as

post-test instruments to determine what learning had taken place. Each of these tests was constructed by the experimenter. One, the Japan Knowledge Test (JKT) was designed to measure the acquisition of knowledge, and the other, the Higher-Learning Test (HT), was designed to measure the acquisition of higher-learning skills and abilities, Reliability coefficients for these instruments appear in Table 3 and a description of each follows.

TABLE 3

Kuder-Richardson 20 Reliability Estimates for Measuring Instruments

Instrument	Number of Ss	Reliability	Mean	SD
Japan Knowledge Test (Pretest)	158	.74	16.05	5.99
Japan Knowledge Test (Post-test)	158	.87	26.52	9.42
Higher-learning Test (Pretest)	158	.83	20.10	7.96
Higher-learning Test (Post-test)	158	.91	32.35	11.92

Note. - In view of the direct relationship between the magnitude of a reliability coefficient and the variation of the sample on which it is based, the increase in reliability from pre- to post-test for the two measures of learning can be explained in terms of an increase in variation due to the learning that took place in the intervening interval.

The JKT consisted of 57 knowledge items. Knowledge as used in this study was defined as the simple remembering of previously learned material, and knowledge items were defined as those items

designed for appraising the ability to remember material in essentially the same form in which it was learned (Bloom, 1956). The JKT was a group test and was allotted a time-limit of 45 minutes. As can be seen from Table 3, the KR20 reliability coefficients for the KRT pre- and post-tests were .74 and .87, respectively.

The HT consisted of 67 higher learning items. Higher-learning as used in this study was defined as the ability to use knowledge effectively in dealing with situations that are "new", and higher-learning items were defined as those items designed to present new problems to the testee and thus sample his intellectual skills and abilities above the knowledge level (Bloom, 1956). Higher-learning items, therefore, seek evidence that the S has attached meanings to his knowledge and that he can use that knowledge effectively in dealing with situations that are new to him. The HT was also a group test and was allotted a time-limit of 45 minutes. As can be seen from Table 3, the KR20 reliability coefficients for the HT pre- and post-tests were .83 and .91, respectively.

In conclusion, it should be noted that both the JKT and the HT were judged by the experimenter to have face validity in terms of the definitions of knowledge and higher-learning as well as in terms of the content of the Japan Unit. Further, as all comparisons made in the present study involved group means and not individual scores, the reliability estimates of these instruments were judged to be acceptable.

Procedures

Instructional methods. Two methods of instruction, a discovery method and an expository method, were used to present the Japan Unit in the present study.

The discovery method of instruction (D) was defined as a method in which verbalization of the generalization(s) being taught was delayed until the end of the instructional sequence through which the generalization was developed. The S was presented with an ordered and structured series of questions based on the materials of the Japan Unit. The sequence of questioning maximized the possibility of the S formulating the generalization more readily than if the questions were randomly presented. Although the questions were designed to draw the student's attention to the elements of the materials, no hint was given that there was an underlying generalization or relationship between those elements to be discovered. The student, was instructed to attempt to answer all questions and was expected to acquire the generalization(s) through an inference of his own based on the concrete experience provided. At the completion of the instructional sequence, the student was asked to verbalize the generalization. If he was unable to do so, more specific questions were asked and if he was still unable to do so, the generalization was verbalized by the teacher for him.

The expository method of instruction (E) was defined as a method in which the verbalization of the required generalization(s) or relationship(s) between the elements of the geographic materials was the initial step of the instructional sequence through which the generalization was to be taught. At the outset, the generalization was presented to the student and explained verbally. The student then was required to work through all activities related to the generalization. Particular attention was given to ensure that practice was made meaningful by continual stress being placed upon the relationship of the activities to the generalization and "why" the generalization was as it was. Rote learning of the generalization by the student was thus minimized.

In sum, the essential difference between instructional methods was the placement within each instructional sequence of a verbal statement of the geographic relationships or generalizations to be found in and/or supported by the instructional materials. Another major difference between the two treatments was the amount of concrete experience provided the Ss before generalizing from the data contained in the instructional materials.

Instructional procedures. To present the Japan Unit to the experimental Ss, two teachers were selected from a total of 15 applicants. The teachers selected were female, about 30 years of age, had six years of teaching experience at the grade nine social studies level, had not been teaching for two years (due to young

families), possessed permanent teaching certificates, and were salaried for their services.

The teachers previewed the materials and guidebooks for the Japan Unit during the month before commencement of the study. Three one-hour discussions and training sessions were held to ensure that the teachers were familiar with the materials and with the content of the unit. Furthermore, the teaching methods were carefully examined to determine the instructional procedures to be used. In this regard, the procedures in each treatment were largely determined by the requirement that the teachers follow the structural sequences of the instructional activities and materials as presented in the guidebooks. Some aspects of the teacher's behavior, however, were judged to be independent of the guidelines, but still influential in maintaining the essential sequence differences between the two treatments. The characteristics of teaching behavior that seemed to be most operative in this regard were the following: (a) interjection of teacher knowledge; (b) introduction of generalizations; (c) method of answering questions; and (d) method of eliminating false generalizations. Model <u>discovery</u> and <u>expository</u> teaching behaviors were specified on each of these four characteristics for the teachers involved and discussions of each were held. A brief account of the models follows.

(a) Interjection of teacher knowledge -- Treatment E. The teacher acts as the primary source of knowledge concerning geography of Japan. The students may depend on the teacher when they cannot work an exercise or answer a question that is presented. The teacher always indicates that she will show the student how to complete any facet of his assigned work correctly. She is never doubtful or uncertain. The teacher checks the answers of the students and explains to them why their answer is right or wrong. In doing so the relationships are referred to as much as possible. When an incorrect answer is given, the teacher recognizes it and immediately asks the student if he is certain that his answer is correct. This gives the student an opportunity to correct his own mistake. If the student is unable to do so, the teacher asks for someone else in the class to respond. Care is taken, however, to avoid any negative evaluation of the student's response.

Treatment D. The teacher does not act as the primary source of knowledge concerning the geography of Japan. She depends on the students to help her learn as they learn. She sometimes reflects an uncertain feeling about the precise way to answer a question or to do an exercise. When given an answer, whether correct or incorrect, she checks it by referring to the data on hand and not by making an authoritarian judgement. When a student gives an incorrect answer, the teacher continues on to the next problem as if unaware that the answer is incorrect. When a student points it out, the teacher acts surprised. If the students fail to notice the mistake, the teacher goes back a short time later, as if she has just realized it, and questions the correctness of the earlier response. The student who gave the response is allowed an opportunity to correct it. If he is unable to do so, specific "guidance" questions that direct his attention to the correct answer are posed. If the student is still unable to do so, other members of the class are asked to respond.

(b) Introduction of generalization -- Treatment E. The teacher gives the generalization (relationship) before the students are given supporting examples or exercises. All subsequent work in the lesson is then related back to the generalization(s) stated at the outset.

Treatment D. The teacher delays the verbalization of the generalization until all, or nearly all of the students have made the "discovery". She is careful to give no hint that there is a relationship or generalization that can be inferred from the materials being studied. If after all exercises are complete and

the students have failed to "discover" the generalization(s) the teacher gives more specific guidance through questioning and if that fails the teacher states the generalization for the students. This is to be a last resort, however.

(c) Method of answering questions -- Treatment E. The teacher answers questions by reiterating and explaining the generalization and relating it to the question. Where such is not appropriate, the teacher answers the question with an air of authority and stresses the procedures that the student should be following.

Treatment D. The teacher answers questions with questions. That is, she asks specific questions designed to lead the students to finding the answer to his own question.

(d) Method of eliminating false generalizations -- Treatment E. The teacher warns students of common errors as they occur. She forewarns the students of errors they might make.

Treatment D. The teacher allows errors to occur even when she knows they might. She corrects errors primarily by asking further questions designed to give greater guidance. She avoids verbalizing the generalization for the students except as a last resort.

Upon completion of the training sessions the two teachers were randomly assigned to classes (and thus treatments) in School A and were told that they would be required to adopt the alternate instructional method and model in School B. Table 4 illustrates the relationship of teachers to schools and treatments. It should be noted that school and teacher were purposely confounded as it was expected that there would be school and teacher differences, and these sources of variation were not of interest in the present study.

TABLE 4

Teacher Assignment to Treatments Within Schools

Treatment	School	
	School A	School B
Expository	Teacher 1	Teacher 2
Discovery	Teacher 2	Teacher 1

Experimental procedures. The Japan Unit was presented to the experimental Ss in School A in 22 successive regularly scheduled 30-minute social studies periods, and in School B in 11 successive regularly scheduled 60-minute periods. In both schools the two experimental classes met at the same time and total instructional time was 11 hours.[3]

The procedure followed in the present experiment was essentially the same for each school. Table 5 illustrates the experimental stages in order of occurrence and the times alloted to each stage.

[3]It is acknowledged by the experimenter that the discrepancy between 30-minute periods and 60-minute periods is likely a significant source of variation. This variable, however, was an artifact of the school administrative structure and was beyond the control of the experimenter. To compensate, the unit was so designed that natural breaks in the instructional stages came after every 30-minute block. Furthermore, this source of variation, like that of the teacher and school variables, was purposely confounded as it was of no interest in the present study.

TABLE 5

Experimental Stages and Time Allotments

Stage	Time	Description
Pretests	90 minutes	Japan Knowledge test and Higher-learning tests
Activity I	90 minutes	Introduction to Japan unit
Activity II	120 minutes	Modernization and population growth
Activity III	90 minutes	Population in pre-modern Japan
Activity IV	150 minutes	Redistribution of population
Activity V	120 minutes	Distribution of economic activities
Activity VI	90 minutes	Case studies of two cities
Post-tests	90 minutes	Japan Knowledge and Higher-learning tests
Informal Questionnaire	10 minutes	Student comments on selected aspects of the unit as presented to them.

Note. -- A control group was administered the pre- and post-tests but received no special instruction in the intervening period.

Before commencement of the study, the experimenter visited each school and explained to the students concerned that two new teachers would be teaching them for about a month and they were to be assigned to special classes so that a proper experiment could be conducted in order to determine the effectiveness of geographic materials used in a "new" way. At this time, assignment to classes was made and the students were told that the unit they were about to receive constituted part of their normal year's work and that a final evaluation of their work would be turned over to their regular classroom teacher for report card purposes. The

students were not told at this time anything about the nature of the unit to be studied.

All pre- and post-tests were administered to the experimental and control Ss as a group in two specially scheduled sessions. The pretests were administered in a 90 minute session on the day prior to the commencement of the unit. The following comments were read to the Ss before administration of the pretests.

> You are to be given two tests this morning. The first, the Japan Test (Japan Knowledge Test) is designed to determine how much you know about the unit that is about to be given to you. The second, the Geography Test (Higher-learning test) is designed to determine how well you are able to handle geographic materials. You are not expected to know all answers, but you are expected to attempt every item and to answer to the best of your ability. A total of 45 minutes will be allowed for each test. Are there any questions? Let us now turn to the directions given on the front page of the Japan Test.

Directions on the front of the JKT were read aloud with the students following. Upon completion of the JKT, a five minute break was allowed and then the HT was administered following the same procedure. The students were not told that they would be receiving the same tests as post measures upon completion of the unit.

The presentation of the unit was straight-forward. Each day the two teachers were required to keep attendance and to confer with the experimenter both before and after the social studies

period. In this way the teachers were able to keep in lock-step so that the total content received each day was the same for both experimental groups. Further, the experimenter visited both classes in each school every day to make an informal check on the teachers' adherence to the teaching model and instructional method to which they were assigned.

The procedure followed for the post-tests was essentially the same as for the pretests. The following comments were read to the Ss before administration of the post-tests.

> The tests you are about to write are the same as those that you wrote before you began the unit on Japan. This time we are interested in determining what you have learned throughout the unit. Again, attempt every item and answer to the best of your ability. Are there any questions? Let us now turn to the directions given on the front page of the Japan Test.

The same procedure as for the pretests was then followed. Upon completion of the post-tests the students were required to comment on specified aspects of the unit and instruction as described above. The following directions for this informal questionnaire were given at this time.

> On the foolscap provided please make any comments that you can about the following aspects: (a) the materials used for the Japan unit, (b) the way in which your teacher presented the materials, (c) the tests given to you both before and after the unit, and (d) any aspect that you feel would be helpful in assessing your work, the usefulness of the Japan unit or that you wish to make. You must sign your sheet of completed comments so that I can identify you with your test booklets.

> Your comments, however, will be kept in the strictest of confidence and will be read only by me and will in no way be used to your disadvantage. You will be given 10 minutes in which to make your comments; for your reference the suggested headings have been placed on the blackboard.

It should be noted that the regular classroom teachers were released from the classroom during the time that the Japan unit was presented. Also, those teachers who taught social studies to the control classes were specifically asked not to discuss Japan or to assign work activities on Japan until after the experiment was complete. In this regard, the teacher of the control class in school A later informed the experimenter that he had permitted his students to spend the month independently researching any world region of their choice and that "many" of his students chose Japan as their topic -- a fact that he failed to notice until after their reports were handed in at the end of the month. A note was made of this occurrence so that it could later be considered in the interpretation of results.

In summary, two teachers were selected to present the Japan Unit to the experimental Ss by the prescribed methods of instruction. The teachers were given prior instruction and training as to the nature of the methods and materials to be employed, and each presented the Japan Unit twice, once using the discovery method and once using the expository method. Two specially formed Grade

Nine classes in each of the two schools received the instruction over 11 hours; the classes in School A were presented the unit in one month and the classes in School B received instruction in a second month. Within each school an intact class was selected as a control group which received all pre- and post-tests but no special instruction. Informal checks were made each day to ensure that the teachers did not violate the instructional models.

Experimental Design

The independent variables given consideration in the present experiment were task presentation and cognitive style. Two levels of task presentation (discovery and expository) and two levels of cognitive style (analytic and global) were factorially combined to form a 2 x 2 design. Subjects from each of the levels of cognitive style were randomly assigned to the treatment conditions; males and females were assigned independently. Table 6 illustrates the resultant frequencies in each experimental condition after assignment for males and females.

TABLE 6

Male and Female Frequency by Experimental Conditions

		Instructional Method	
Cognitive Style	Sex	Expository	Discovery
Analytic	Male	17	19[a]
	Female	11	12[b]
Global	Male	14[a]	12
	Female	16	16

[a]Two Ss were dropped from this cell to obtain proportionate subclass frequencies for subsequent analysis.

[b]One S was dropped from this cell to obtain proportionate subclass frequencies for subsequent analysis.

Controls and limitations. To maximize the replicability and generalizability of the present study, the critical nonexperimental variables as well as the potential threats to internal and external validity were identified and controls for each were set up. With respect to the nonexperimental variables, procedural techniques were employed as follows. The Ss in Treatments D and E received the same length of time to work on the learning tasks. The amount of verbalization in the teacher's oral presentation and in the written instructional materials was held as constant as possible in both treatment conditions. Verbalization of the desired geographical generalizations was varied in sequence between the two treatments but was present in both. Finally, directions to

both treatment groups were as identical as possible, and both groups were made to feel that they held shared status in an experiment concerned with the use of "new geography materials".

With respect to internal validity, the paradigm involved pretests and post-tests with random assignment to groups and treatments. Analysis of the pretest results did not indicate any reliable difference between the experimental groups with respect to knowledge of Japan or with respect to higher-learning skills and abilities. The design was therefore regarded as having controlled the main effects of history, maturation, testing, and instrumentation in that any difference between pretest and post-test performance cannot be explained by main effects of these variables (Campbell and Stanley, 1966). Thus it can be said that any results arising out of the present experiment have internal validity.

With respect to external validity, the main threats in the present study seemed to be (a) interaction of pretesting and the experimental treatments, (b) interaction of selection and the experimental treatments, and (c) reactive arrangements. Each will be considered in turn.

Campbell and Stanley (1963) in discussing interaction of pretesting and experimental treatments state that if the experimental tests are similar to those usually used as classroom

tests, no undesirable interaction of testing and treatments is likely to be present. As the tests used in the present study are typical of classroom tests, this source of invalidity may be discounted.

Interaction of selection and the experimental treatments does not seem to be a serious threat to external validity in the present study. There is no reason to believe that the schools selected to take part in the experiment were unrepresentative of the schools in the Victoria area. Both schools had similar populations of Grade Nine students, and both were about the same size. Finally, the regular routines of the schools were not upset, as regularly scheduled social studies periods were used, and a unit that was part of the normal curriculum was presented to the Ss.

A more serious danger to external validity is that of reactive arrangements. The subjects knew, and in fact were told that they were involved in an experiment. In this regard, however, examination of the comments made by the Ss on the informal questionnaire presented after the post-tests revealed that the Ss were not aware of the fact that two instructional methods were being compared. Further, there is no reason to believe that the subjects would be aware of the cognitive style variable given consideration in the present experiment. With respect to the use of teachers who were "new" to the students, the length of

the experiment likely minimized any effect that such novelty might have had.

In conclusion, the research design used in the present study experimentally controlled for the major variables that might have lessened validity (history, maturation, testing, and instrumentation, Those sources of variation that might have affected the extemnal validity of the study (interaction of testing and treatment, interaction of selection and treatment, and reactive arrangements) were judged to be minimal. Finally, the major nonexperimental variables felt to be critical in this study were controlled with procedural techniques.

CHAPTER III

Results and Discussion

The presentation and discussion of results of this study were organized under three major headings: pretest data, control group data, and post-test data. Post-test data for males and females were examined separately. Furthermore, the post-test data were re-examined for extreme analytic-global males and females.

Pretest Data

Two pretest measures were obtained: per cent correct on the JKT and per cent correct on the HT. The main purpose of these measures was to determine the initial comparability of the discovery and expository groups in terms of knowledge of Japan and in terms of the ability to handle geographic materials. Table 7 presents the mean per cent correct for the JKT and the HT pretests for the two experimental groups.

TABLE 7

Mean Per Cent Correct For Experimental Groups on Pretests

Test	Method of Instruction	
	Expository	Discovery
Knowledge	29.40	29.35
Higher-learning	29.46	33.78

A comparison of the discovery and expository means revealed that in terms of knowledge of Japan, there was no significant difference ($t = 0.027$; $df = 58$; $p > .05$). In terms of ability to handle geographic materials, however, there tended to be a difference in favour of the discovery Ss ($t = 1.90$; $df = 58$; $p > .05$, $p < .10$). It was concluded, therefore, that in terms of prior knowledge of the unit to be presented, the experimental groups were comparable, but that in terms of the ability to handle geographic materials similar to those used in the unit, there was a slight difference in favour of the discovery group. This difference, however, was not considered to be large enough to bias subsequent results.

Control Group Data

The purposes of administering the pre- and post-tests to a control group were to determine the practice effects of testing and to provide baseline data with which to determine the effects of the two experimental treatments.

Practice effects. The mean per cent correct on the JKT and HT pre- and post-tests for the control Ss are presented in Table 8. It was found that there was a significant improvement made from the pretest to the post-test on both the JKT and the HT ($t = 3.46$; $df = 40$; $p < .001$, and $t = 3.66$; $df = 40$; $p < .05$, respectively). This significant improvement indicated either that there was a

practice effect of testing or that some other factor which facilitated learning about Japan had occurred between the pre- and post-test sessions.

TABLE 8

Mean Per Cent Correct on Pretests and Post-Tests for Control Group

Learning Measure	Session of Testing	
	Pre-	Post-
Japan Knowledge Test	24.82	35.53
Higher-learning Test	25.63	31.79

As the teacher of the control Ss in School A had informed the experimenter that "many" of his students had independently researched Japan during the inter-test session, it was decided to examine the pre- and post-test means on the two learning measures separately for Schools A and B. Control group means for each school are presented in Table 9. It was found that for School A the control group had made a significant improvement from the pre-test to the post-test on both the JKT and the HT ($t = 4.31$; $df = 15$; $p < .001$, and $t = 3.78$; $df = 15$; $p < .05$, respectively). For School B, however, there was no reliable difference on either the JKT or the HT ($t = 1.93$; $df = 24$; $p > .05$, and $t = 1.89$; $df = 24$; $p > .05$, respectively).

TABLE 9

Mean Per Cent Correct on Knowledge and Higher-Learning Pre- and Post-Tests for Control Ss by School

Learning Measure	School	Session of Testing	
		Pre-	Post-
Japan Knowledge Test	A	27.19	35.53
	B	23.30	25.19
Higher-learning Test	A	29.28	37.88
	B	21.43	26.69

The above results were interpreted as indicating that there was no reliable practice effect of testing in the present study, but that there was a significant intrasession improvement made by the Control Ss in School A which was the result of these Ss being given opportunity to study the geography of Japan. It was concluded, therefore, that any improvement made by the experimental Ss from the pretest session to the post-test session can be attributed solely to the effects of the experimental treatments. It was also concluded, however, that a direct comparison of the experimental and control groups to determine the effects of the experimental treatments was not feasible.

Treatment effects. In order to determine the effects of the experimental treatments in terms of the extent to which they facilitated learning, the pretest and post-test means for each of the instructional methods were compared. Table 10 presents

pre- and post-test mean per cent correct for the experimental Ss for each treatment on both learning measures.

TABLE 10

Mean Per Cent Correct on Knowledge and Higher-learning Pre- and Post-Tests for Experimental Ss Across Treatments

Test	Treatment	Testing Session	
		Pre-	Post-
Knowledge	Expository	29.40	52.33
	Discovery	29.35	52.84
Higher-learning	Expository	29.46	51.82
	Discovery	33.78	56.25

It was found that for the Expository treatment, there was a reliable improvement from pre- to post-test on both the JKT and the HT ($t = 9.96$; $df = 57$; $p < .001$, and $t = 8.71$; $df = 57$; $p < .001$, respectively). For the Discovery treatment, there was also a significant improvement on both the JKT and the HT ($t = 11.44$; $df = 58$; $p < .001$, and $t = 9.07$; $df = 58$; $p < .001$, respectively). It was concluded, therefore, that both instructional methods reliably facilitated learning in terms of knowledge about Japan and in terms of the ability to handle geographic materials.

In summary, the pretest and control group data indicated that in terms of knowledge about the unit to be presented, there was no reliable difference between the experimental groups. In

terms of the ability to handle geographic materials, however, there was a slight difference in favour of the discovery group. This difference was interpreted as reflecting a sampling bias and was not considered to be large enough to significantly affect any conclusions based on the post-test data. It was found that there was no significant improvement made by the control group from the pretest to the post-test session except for that part of the control group that had independently studied the geography of Japan. For the experimental Ss, however, there was a significant improvement made from the pretest to the post-test session under both treatments. It was concluded, therefore, that the experimental groups were comparable in terms of knowledge of Japan and in terms of higher-learning skills and abilities, and also that any gains made from the pretest to the post-test session resulted solely from the treatment effects.

Post-Test Data

Two post-test measures of learning were obtained: per cent correct on the JKT, and per cent correct on the HT. Because each of these measures samples different levels of the cognitive domain (Bloom, 1956) data will be reported separately for knowledge and higher-learning. Although there was a reliable sex difference on the cognitive style variable with males being more analytic than females, whenever the analysis of variance based on the JKT and

HT scores yielded essentially identical results for both males and females, only the data based on the performance of the males will be reported. Data for males and females are presented separately in Appendices A and B.

All analyses reported are two-way analysis of variance with proportionate subclass frequencies (Stanley, 1963). Where proportionate subclass frequencies were not present, proportionality was obtained through random dropping of Ss from the cells concerned. Not more than two Ss were dropped from any cell and in total, only five Ss (4 males and 1 female) were dropped (see Table 7).

Knowledge (JKT). The results of the analysis of variance on per cent correct for the JKT for males are summarized in Table 11. Neither the main effect of Method of Instruction, Cognitive Style, nor the interaction of Method of Instruction and Cognitive Style were significant. Table 12 presents the mean per cent correct on the JKT for cognitive style and methods. The failure to find any significant main effects or interaction involving cognitive style and method of instruction leads to the conclusion that discovery and expository methods of instruction which differ primarily in sequence characteristics do not differentially influence acquisition of geographic knowledge and that this trend was consistent for both analytic and global males. This finding does not support that of Worthen (1968) who found that for knowledge, an expository sequence was superior. Worthen's study concerned mathematics at

the elementary school level, while this study concerned geography at the secondary school level. It seems, therefore, that the discrepancy between results was a function of age and/or subject matter differences. Furthermore, it is possible that instructional method and cognitive style do interact in terms of knowledge, but that they do so only for extreme analytic and extreme global Ss.

TABLE 11

Summary of Analysis of Variance on Per Cent Correct on JKT for Males

Source	df	MS	F
Method of Instruction (M)	1	33.37	<1
Cognitive Style (CS)	1	131.21	2.29
M x CS	1	54.89	<1
Error	54	57.19	
Total	57		

TABLE 12

Mean Per Cent Correct as a Function of Cognitive Style and Method of Instruction for Males on JKT

Cognitive Style	Method of Instruction		
	Expository	Discovery	Mean
Analytic	57.06	56.85	56.96
Global	48.24	54.97	51.60
Mean	53.41	56.07	

Higher-learning (HT). The results of the analysis of variance on per cent correct for the HT for males are summarized in Table 13. The main effect of Cognitive Style was significant ($F(1.54) = 5.95$; $p < .05$). Table 14 presents the mean per cent correct on the HT for cognitive style and methods. The significant main effect of Cognitive Style merely indicated that analytic males were able to handle geographic materials better than were global males and that this trend was consistent across both methods of instruction. This finding leads to the conclusion that analytic males developed a greater ability to apply geographic generalizations to new situations than did global males. An alternate interpretation is that the main effect for cognitive style merely reflects the nature of the HT which required that Ss analyze geographic materials as well as to apply acquired generalizations to new situations. The failure to find any significant main effects for method of instruction does not support Worthen (1968) who found that a discovery sequence was superior on tests of ability to apply knowledge to new situations. As was the case for knowledge, this discrepancy could well be a difference in subject matter and/or a difference in the age of the groups concerned. Finally, although there was no significant interaction between cognitive style and method of instruction for higher learning, it is possible that method and cognitive style do interact but they do so only for extreme analytic and extreme global males.

TABLE 13

Summary of Analysis of Variance on Per cent Correct on HT for Males

Source	df	MS	F
Method of Instruction (M)	1	169.00	1.64
Cognitive Style (CS)	1	611.13	5.95*
M x CS	1	48.13	<1
Error	54		
Total	57		

*$p < .05$

TABLE 14

Mean Per cent Correct as a Function of Cognitive Style and Method of Instruction for Males on HT

Cognitive Style	Method of Instruction		
	Expository	Discovery	Mean
Analytic	58.18	60.93	59.55
Global	45.52	53.85	49.68
Mean	52.94	58.00	

In summary, it was found that the sequence of instruction (discovery and expository) did not differentially influence the performance of Grade Nine students (males and females) in a geography learning situation, and that this lack of differential effect was evident for both knowledge and higher learning. This finding was not consistent with that of Worthen (1968) who found

that the sequence variable differentially influenced the performance of elementary school students in a mathematics learning situation. It was felt that the discrepancy between Worthen's results and the results of this study could be a function of differences in subject matter and in the age of the students involved. It was also found that there was no reliable relationship between the cognitive style variable and learning performance on a measure of knowledge. On a measure of higher-learning, however, analytic Ss (males and females) were consistently superior. Two conclusions were suggested by this finding. One was that analytic Ss developed a greater ability to apply geographic generalizations to new situations than did global males and that this development was not dependent on method. The other conclusion was that the cognitive style difference merely reflected the nature of the HT which required analysis as well as application.

Finally, it was concluded that it was possible that instructional method and cognitive style do interact but that they do so only for extreme analytic and extreme global Ss. It was decided, therefore, to identify extreme analytic and extreme global male and female Ss and to conduct separate analyses for their scores on both the JKT and the HT.

Extreme Male and Female Post-Test Data

Extreme analytic males and females were defined as those Ss

who obtained a score on the HFT of 22 or more. Extreme global Ss were defined as those who obtained a score on the HFT of 14 or less. The cutting points used to identify extreme global-analytic Ss were selected so as to increase the difference between global and analytic Ss and still retain at least five Ss under each experimental condition. In total 74 extreme analytic-global Ss were identified. The dependent variables and the analysis of variance model that were used for the data for the extreme analytic-global Ss were the same as those used for the data for all Ss. As the results of the analysis of variance on the JKT scores were essentially the same as the results of the analysis of variance based on the HT scores, only the data for the HT will be reported for the extreme analytic-global females (extreme females). For the extreme analytic-global males (extreme males), however, the results of the separate analyses were quite different, hence data for both learning measures are reported. Data for all extreme Ss are presented in Appendices C and D.

Extreme Analytic-Global Males

Knowledge (JKT). The results of the analysis of variance on per cent correct on the JKT for extreme males are summarized in Table 15. The Method by Cognitive Style interaction was significant ($F(1.42) = 4.53$; $p < .05$). Table 16 presents the mean per cent

correct on the JKT for cognitive style and methods, and Figure 2 illustrates the Method by Cognitive Style Interaction.

TABLE 15

Summary of Analysis of Variance on Per cent Correct on JKT for Extreme Males

Source	df	MS	F
Method of Instruction (M)	1	7.84	1
Cognitive Style (CS)	1	71.96	1.28
M x CS	1	255.46	4.53*
Error	42	56.35	
Total	45		

*$p < .05$

TABLE 16

Mean Per cent Correct on JKT as a Function of Cognitive Style and Method of Instruction for Extreme Males

Cognitive	Method of Instruction		
	Expository	Discovery	Mean
Analytic	59.78	53.98	56.88
Global	47.01	57.89	52.45
Mean	54.23	55.68	

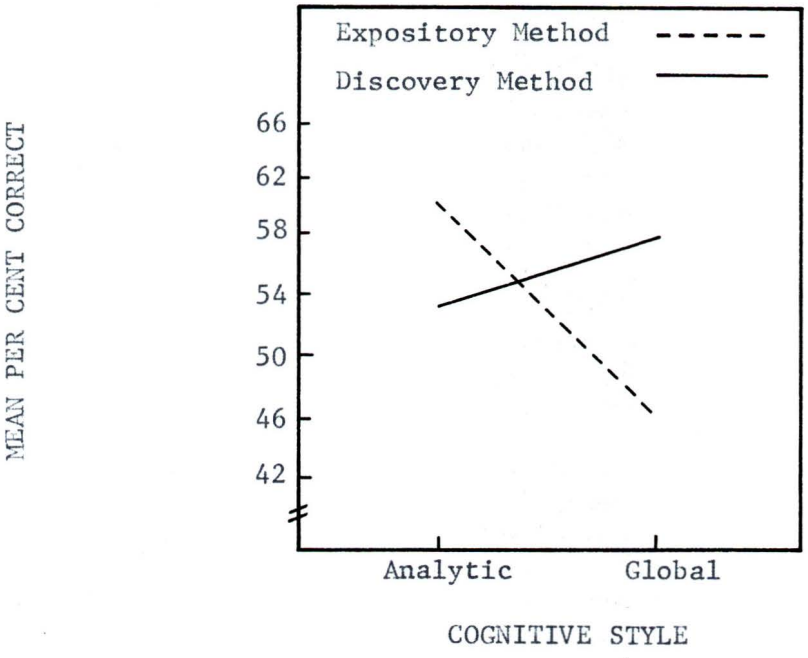

Fig. 2. Mean per cent correct on JKT for instructional methods as a function of cognitive style for extreme males.

Subsequent analysis of the Method by Cognitive Style interaction for the JKT involved mean comparisons between extreme cognitive style levels for each method of instruction separately. A Duncan Multiple Range Test for group means with unequal frequencies (Kramer, 1956; Duncan, 1957) revealed that under the expository method, extreme global males scored significantly lower than did extreme analytic males and there were no other significant differences between cognitive style levels either across or under both methods of instruction.

An interpretation of this interaction is suggested by Ausubel (1963). In his discussion of the psychological and educational rationale of the discovery method, Ausubel states that

when the learning task is difficult and unfamiliar, discovery techniques probably enhance learning by intensifying and personalizing both "the concreteness of experience and the actual operations of abstracting and generalizing from empirical data (p. 143)." For extreme global male Ss it can thus be concluded that the more concretely based discovery sequence used in this study enabled them to perform as well as extreme analytic Ss under either method, and that the less concrete, more abstract (verbal) expository sequence did not facilitate the performance of extreme global males. It will be recalled that a significant interaction between method and cognitive style was not evident for all global males. The data suggest, therefore, that the more global a male S is the more he will benefit from methods of instruction that provide concrete experiences designed to develop knowledge.

Higher-learning (HT). The results of the analysis of variance on per cent correct on the HT for extreme males are summarized in Table 17. The main effect of Cognitive Style was significant ($F(1.42) = 4.61$; $p < .05$), as was the Method by Cognitive Style interaction ($F(1.42) = 5.19$; $p < .05$). Table 18 presents the mean per cent correct on the HT for cognitive style and methods, and Figure 3 illustrates the Method by Cognitive Style interaction.

TABLE 17

Summary of Analysis of Variance on Per cent Correct on HT for Extreme Males

Source	df	MS	F
Method of Instruction (M)	1	119.04	1.35
Cognitive Style (CS)	1	405.91	4.61*
M x CS	1	456.36	5.19*
Error	42	88.00	
Total	45		

*$p < .05$

TABLE 18

Mean Per cent Correct on HT as a Function of Cognitive Style and Method of Instruction for Extreme Males

Cognitive Style	Method of Instruction		
	Expository	Discovery	Mean
Analytic	61.53	57.52	59.52
Global	42.53	58.05	50.29
Mean	53.27	57.75	

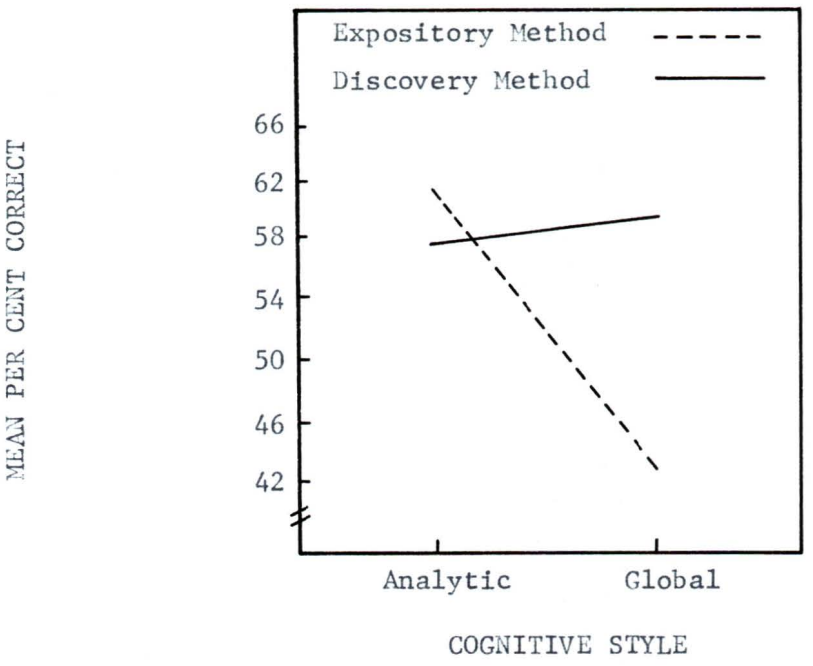

Fig. 3. Mean per cent correct on HT for instructional methods as a function of cognitive style for extreme males.

The significant main effect of Cognitive Style on the HT indicated that extreme analytic males better developed the ability to apply geographic generalizations to new situations than did extreme global males and that this trend was consistent across both methods. The main effect for cognitive style could also be a reflection of the nature of the HT which required analysis of geographic materials as well as the application of generalizations.

Subsequent analysis of the Method by Cognitive Style interaction for the HT involved mean comparisons between extreme cognitive style levels for each method of instruction separately. A Duncan Multiple Range Test for group means with unequal frequencies revealed that the extreme global group under the expository method

scored significantly lower than did all other groups which did not differ significantly from each other. As there was no significant difference between extreme global and analytic males under the discovery method, it may be concluded that the significant main effect of Cognitive Style was manifested only under the expository method. The significant interaction suggests that the extreme global males under the discovery method were given sufficient practice in analyzing geographic materials to enable them to perform as well as extreme analytic males on the HT. The expository method, however, did not require that the Ss analyze geographic materials, hence the extreme global males were not able to benefit. Furthermore, it would seem that extreme analytic males did not benefit from the practice offered by the discovery method. In this respect, it is likely that the ability to analyze geographic materials was well developed before instruction. Hence, for extreme analytic males the method of instruction was not as relevant to performance on the HT as it was for extreme global males.

Extreme Analytic-Global Females

Higher-learning (HT). For extreme analytic-global females, the results of the analysis of variance of the JKT and of the HT were essentially the same, hence only the data for the HT will be reported.

The results of the analysis of variance on per cent correct on the HT for extreme analytic-global females is summarized in Table 19. The main effect of Cognitive Style was significant ($F(1.24) = 12.33$; $p < .01$). Table 20 presents the mean per cent correct on the HT for extreme females by cognitive style and methods of instruction. The significant main effect of Cognitive Style merely indicated that extreme analytic females scored higher than extreme global females and that this trend was consistent across both methods of instruction.

TABLE 19

Summary of Analysis of Variance on Per cent Correct on HT for Extreme Females

Source	df	MS	F
Method of Instruction (M)	1	6.04	1
Cognitive Style (CS)	1	1039.53	12.33**
M x CS	1	13.36	1
Error	24	84.34	
Total	27		

** $p < .01$

TABLE 20

Mean Per cent Correct on HT as a Function of Cognitive Style and Method of Instruction for Extreme Females

Cognitive Style	Method of Instruction		
	Expository	Discovery	Mean
Analytic	62.19	63.18	62.68
Global	45.89	42.72	44.31
Mean	52.87	51.49	

It will be recalled that these results are identical to those for all females in terms of higher-learning, but that in terms of knowledge, there was no significant main effect for Cognitive Style for all females. In terms of knowledge, therefore, it would seem that extreme global females as compared to extreme analytic females, experience more difficulty no matter which method of instruction is used. In terms of the ability to handle geographic materials, however, it would seem that as was the case for all females, the main effect of Cognitive Style was either a reflection of the nature of the HT or indicative that extreme analytic females better developed the ability to apply geographic generalizations to new situations than did extreme global females and that this trend was consistent across methods. Furthermore, for extreme global males, it was found that the more concrete discovery method facilitated the acquisition of knowledge as compared to the more

abstract or verbal expository method. It was suggested that the discovery technique probably facilitated learning for the extreme global males by intensifying and personalizing the learning experience. It was also found that for the extreme global males performance on the HT was superior under the discovery method. In this instance, it was suggested that the practice afforded by the discovery technique with respect to analyzing geographic materials enabled extreme global males to perform as well as did extreme analytic males. One can only speculate as to why the extreme global females did not benefit in a like manner.

As there was a sex difference with respect to the cognitive style variable, with males being more analytic than females, it could be that the extreme global males were better able to benefit from the discovery method of instruction than were the extreme global females. It will be remembered that this technique required the analysis of geographic materials to induce relationships between elements and to form geographic generalizations. If the cognitive style sex difference was a critical variable, it would follow that the extreme global males would benefit more both in terms of the meaningfulness of the learning experience with respect to knowledge and in terms of the practice effect with respect to ability to handle geographic materials in new situations. It would seem, then, that arranged on a continuum from high ability to perform tasks requiring analysis of geographic

materials to low ability to perform tasks requiring analysis of geographic materials, the order would be: extreme analytic males, extreme analytic females, extreme global males and extreme global females. To establish empirical support for such a continuum, however, an experiment that controls for all other possible sources of variance would have to be conducted.

An alternate explanation that may provide a basis for resolving the discrepancy concerns differences in aptitude. It is well established that males typically score higher than do females in quantitative and spatial items in both intelligence and achievement tests (Klausmeier & Goodwin, 1965). As the Japan Unit consisted of materials that were spatial in nature (maps, aerial photographs, and pictures) and of materials that were quantitative in nature (statistical tables), it is possible that this difference in aptitude operated in favour of the extreme global males. This explanation could also be tested by a well controlled experiment.

In summary, it was found that the sequence of instruction (discovery and expository) did not differentially influence the performance of extreme analytic-global females or males on either the measure of knowledge or the measure of higher-learning skills and abilities. Furthermore, it was found that for extreme analytic-global females, analytic females performed better under

both methods and on both measures of learning. Finally, it was found that for extreme analytic-global males, global males taught by the expository method performed poorer on both measures of learning than did all other groups which did not differ significantly from each other.

CHAPTER IV

Summary and Conclusions

The academic performance of Grade Nine geography students was studied as a function of task presentation and cognitive style. Instructional methods were operationally defined in terms of the sequence with which instruction was given, and cognitive style was operationally defined in terms of an individual's performance on the HFT. The learning task involved the acquisition of knowledge of the geography of Japan and the acquisition of the ability to apply geographic generalizations and to handle geographic materials in new situations. Two dependent variables were considered: knowledge as measured by the JKT and higher-learning as measured by the HT. The Ss were 118 Grade Nine students randomly assigned to four classes within two schools (two per school). In addition, two intact classes (one per school) were selected to serve as a control group which was given all pre- and post-tests but no special instruction in the intervening period. The paradigm consisted of pretests to establish comparability of the experimental groups and post-tests to establish the effect of the independent variables, method of instruction and cognitive style. The Ss were presented with 11 hours of instruction through typical geographic materials introduced by two specially selected teachers trained in both discovery and expository sequencing.

The specific questions considered in the experiment were:

1. In what manner does the sequence of task presentation in a geography learning situation influence the performance of (a) male Grade Nine students? (b) female Grade Nine students?

2. In what manner is an individual's cognitive style, as identified by the HFT, related to performance in a geography learning situation for (a) male Grade Nine students? (b) female Grade Nine students?

3. In what manner does the sequence of task presentation in a geography learning situation influence the performance of individuals who manifest different cognitive styles, as identified by the HFT for (a) males? (b) females?

It was found that the sequence of task presentation did not differentially influence the acquisition of knowledge or the development of the ability to apply that knowledge to new situations for either males or females. These findings were not consistent with those of Worthen (1968) who found that for knowledge, an expository sequence was significantly more effective and that for transfer (higher-learning), a discovery sequence was superior. It was felt, however, that as Worthen's study was concerned with mathematics at the elementary school level, the discrepancy was likely a function of differences in subject matter and/or age levels. It would be of interest, therefore to replicate Worthen's study at the junior high school level and to replicate this study at the elementary school level.

It was also found that for neither males nor females, was cognitive style significantly related to performance in terms of

knowledge, but that it was in terms of higher-learning. On the higher-learning measure, analytic Ss were superior. Data from laboratory studies concerned with cognitive style suggest that a person's cognitive style is significantly correlated with his performance in a variety of learning tasks such as problem solving, serial learning, and concept identification (Guetzkow, 1951; Gardner & Long, 1960; and Davis, 1967). It would seem then that in terms of knowledge the results of this study do not agree with the research evidence reported elsewhere but that in terms of higher-learning there is agreement. With respect to knowledge, it was felt that the discrepancy might be a function of differences between learning tasks in the classroom and learning tasks in the laboratory. Furthermore, it was considered possible that the main effect of cognitive style might be evident, but only for those Ss who are extremely analytic or global. With respect to higher-learning, it was felt that analytic Ss acquired a greater ability to apply generalizations in new situations and also that the difference between analytic and global Ss might be a reflection of the nature of the HT which required the analysis of materials as well as application of knowledge.

Finally, it was found that there was no significant interaction between method of instruction and cognitive style for males or females either in terms of knowledge or in terms of higher-learning. It was felt, however, that such an interaction

might exist but that it did so only for extreme analytic and extreme global Ss.

Extreme analytic-global Ss were then identified in terms of their HFT scores and their data were examined separately. The findings for the extreme Ss were different from those for all Ss in two major respects. First, for extreme females, it was found that in terms of knowledge, cognitive style was significantly related to performance in that analytic females performed better than did global females. Second, for extreme males, it was found that both in terms of knowledge and in terms of higher-learning, there was a significant interaction between method of instruction and cognitive style. For knowledge, extreme global males scored significantly lower under the expository method than did extreme analytic males under the expository method. All other differences between the levels of cognitive style both across and under methods of instruction were non-significant. For higher-learning, the extreme global group under the expository method scored significantly lower than did all other groups which did not differ.

The cognitive style difference for extreme females was seen to be consistent with the findings of laboratory studies concerned with cognitive style. It would seem, then that for extreme analytic-global females, one's ability to acquire knowledge is a function of her ability to analyze complex stimuli. The significant

interaction of method by cognitive style for the extreme males was interpreted in terms of Ausubel's hypothesis which states that for learning tasks that are difficult, a discovery technique will enhance performance by making the learning experience more intensely personalized through concrete experiences. It would seem that such was the case for extreme global males taught by the discovery method in this study. Finally, two possible explanations for the sex difference (differences in analytic ability and differences obtained in quantitative and spatial aptitude) were suggested.

In conclusion, this study demonstrated that to the extent that student ability to acquire knowledge and to handle geographic materials in new situations are valued outcomes of instruction, the choice of either a discovery or an expository sequence is not relevant at the junior high school level. However, to the extent that education should concern itself with the individual differences of students, it would seem that global, or non-analytic, students would require assistance in geography learning tasks to a greater extent than would analytic students. This need to accommodate differences in cognitive style exists for both males and females. Further, in the case of extreme non-analytic males, it would seem that a discovery sequencing should be an integral part of the methodology used in teaching with geographic materials in the Grade Nine classroom so that the learning experience may

be made more meaningful. For extreme nonanalytic females, however, some other technique seems to be required to enable them to learn more efficiently in terms of acquiring knowledge and in terms of developing the ability to handle geographic materials in new situations.

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APPENDICES

APPENDIX A

Summary of Analysis of Variance on Per cent Correct on Japan Knowledge Test (JKT) and on Higher-learning Test (HT) for Males and Females

Sex	Source	df	JKT MS	JKT F	HT MS	HT F
Male	Method of Instruction (M)	1	33.37	<1	169.00	1.64
	Cognitive Style (CS)	1	131.21	2.29	611.13	5.95*
	M x CS	1	54.89	<1	48.13	<1
	Error	54	57.19		102.54	
	Total	57				
Female	Method of Instruction (M)	1	0.07	<1	42.69	<1
	Cognitive Style (CS)	1	70.06	1.42	817.88	9.88**
	M x CS	1	22.65	<1	20.75	<1
	Error	50	49.37		82.79	
	Total	53				

*$p < .05$

**$p < .01$

APPENDIX B

Mean Per cent Correct as a Function of Cognitive Style and Method of Instruction for Males and Females

Sex	Learning Measure	Cognitive Style	Method of Instruction		
			Expository	Discovery	Mean
Male	Japan Knowledge	Analytic	57.06	56.85	56.96
		Global	48.24	54.97	51.60
		Mean	53.41	56.07	
	Higher-learning	Analytic	58.18	60.93	59.55
		Global	45.52	53.85	49.68
		Mean	52.94	58.00	
Female	Japan Knowledge	Analytic	53.74	50.87	52.31
		Global	49.12	49.11	49.12
		Mean	51.43	49.99	
	Higher-learning	Analytic	56.58	56.91	56.75
		Global	46.64	47.76	47.20
		Mean	50.69	51.49	

APPENDIX C

Summary of Analysis of Variance on Per cent Correct on Japan Knowledge Test (JKT) and on Higher-learning Test (HT) for Extreme Males and Females

Sex	Source	df	JKT MS	JKT F	HT MS	HT F
Male	Method of Instruction (M)	1	7.84	1	119.04	1.35
	Cognitive Style (CS)	1	71.96	1.28	405.91	4.61*
	M x CS	1	255.46	4.53*	456.36	5.19*
	Error	42	56.35		88.00	
	Total	45				
Female	Method of Instruction (M)	1	22.32	1	6.04	1
	Cognitive Style (CS)	1	284.17	6.06*	1039.53	12.33**
	M x CS	1	93.24	1.99	13.36	1
	Error	24	46.85		84.34	
	Total	27				

*$p < .05$

**$p < .01$

APPENDIX D

Mean Per cent Correct as a Function of Cognitive Style and Method of Instruction for Extreme Males and Females

Sex	Learning Measure	Cognitive Style	Method of Instruction		
			Expository	Discovery	Mean
Male	Japan Knowledge	Analytic	59.78	53.98	56.88
		Global	47.01	57.89	52.45
		Mean	54.23	55.68	
	Higher-learning	Analytic	61.53	57.52	59.52
		Global	42.53	58.05	50.29
		Mean	53.27	57.75	
Female	Japan Knowledge	Analytic	60.52	50.00	55.26
		Global	42.76	45.17	43.96
		Mean	50.37	47.24	
	Higher-learning	Analytic	62.19	63.18	62.68
		Global	45.89	42.72	44.31
		Mean	52.87	51.49	

APPENDIX E:

Japan Knowledge Test
Higher-learning Test

NAME: _____ SEX: M or F School: _____
(surname first)
Division: _____

JAPAN KNOWLEDGE TEST

Directions: Unless otherwise indicated, each item consists of a question or incomplete statement followed by four suggested answers or completions. Select the answer which is best in each case and then write its corresponding letter in the answer blank on the right.

Example:

1. Victoria is a

   A. state
   B. city
   C. country
   D. continent

SAMPLE ANSWER

1. B

You are not expected to know all of the answers, but answer each question to the best of your ability.

Time -- 45 minutes

DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO.

1. Which of the following nations is nearest to Japan?

   A. Soviet Union

   B. Viet Nam

   C. Indonesia

   D. India

   1. _____

2. Which of the following Western ideas has had the least influence on the Japanese way of life?

   A. The Christian religion

   B. Skiing and baseball

   C. Television and movies

   D. Hamburgers and cokes

   2. _____

3. In the last century, the population of Japan has

   A. increased in numbers only.

   B. increased in numbers and density.

   C. decreased in numbers only.

   D. decreased in numbers and density.

   3. _____

4. The farms in Japan before industrialization produced nearly everything the family needed. This is an indication that at the time

   A. the Japanese farmers were better at their job than they are today.

   B. trade was not a part of Japan's economy.

   C. the transportation system was inadequate.

   D. the rural areas of Japan enjoyed a high standard of living.

   4. _____

5. The daily life of the average Japanese today is most similar to the daily life of

   A. an American today.

   B. a Chinese today.

   C. a Japanese 100 years ago.

   D. an American 100 years ago.

   5. _____

6. Which of the following made the least important contribution to the modernization of Japan?

   A. Trade with foreign countries

   B. The discovery of new mineral resources

   C. the development of agriculture

   D. The development of industry

6. _____

7. The northernmost and southernmost extent of Japan's four main islands is most comparable in latitude to that of

   A. the east coast of Africa.

   B. the coast of Scandinavia.

   C. the east coast of the United States.

   D. the east coast of Central America.

7. _____

8. An area in Japan that has lost population steadily in the past twenty years is most likely to be

   A. a major city.

   B. the suburb of a major city.

   C. a town.

   D. a rural area.

8. _____

9. The increasing ability of Japan to support its people has resulted most directly from a marked increase in

   A. the number of Japanese moving to other countries.

   B. the amount of land cultivated within Japan.

   C. agricultural laborers.

   D. industrial production and commercial activity.

9. _____

10. The agricultural population of Japan today is distributed

A. almost exactly as it was a hundred years ago.

B. evenly throughout the rural parts of the country.

C. in much the same way as the overall population of today.

D. mainly in the central part of the country.

10. _____

11. The standard of living in Japan one hundred years ago was most comparable to which of the following nations today?

A. India

B. Italy

C. Japan

D. Sweden

11. _____

12. In which of the following ways is Japan least like the United States?

A. The size of major cities

B. The proportion of farm workers in the labor force

C. The density of population

D. The available forms of transportation

12. _____

13. Present standards of living in Japan are closest to those in which of the following countries?

A. India

B. Italy

C. Algeria

D. People's Republic of China

13. _____

14. Which of the following nations is nearest to Japan?

A. Canada

B. United States

C. India

D. Australia.

14. _____

15. Agricultural production in Japan has increased greatly in the last century primarily because of

A. improvements in farming methods.

B. increases in the amount of cultivated land.

C. an increase in the percentage of the Japanese engaged in farming.

D. government aid to farmers.

15. _____

16. Which of the following is least likely to be a characteristic of a modern industrial country?

A. A high standard of living.

B. A high proportion of the people living in urban areas.

C. A high proportion of the labor force employed in agriculture.

D. A large volume of trade with foreign nations.

16. _____

17. Which of the following is a correct statement about the population of Japan today?

A. It is rather evenly distributed.

B. It is most dense in the warmer regions of the country.

C. It is concentrated in large metropolitan areas.

D. It is mostly concentrated in rural areas.

17. _____

18. The change in Japanese living standards during the last century suggests that

A. a large increase in population does not necessarily mean a decrease in the standard of living.

B. population growth must be halted to enable the standard of living to improve.

C. a country must grow enough food for its population in order to improve its standard of living.

D. a country's standard of living depends largely on its natural resources.

18. _____

19. The shaded portions of the following map show

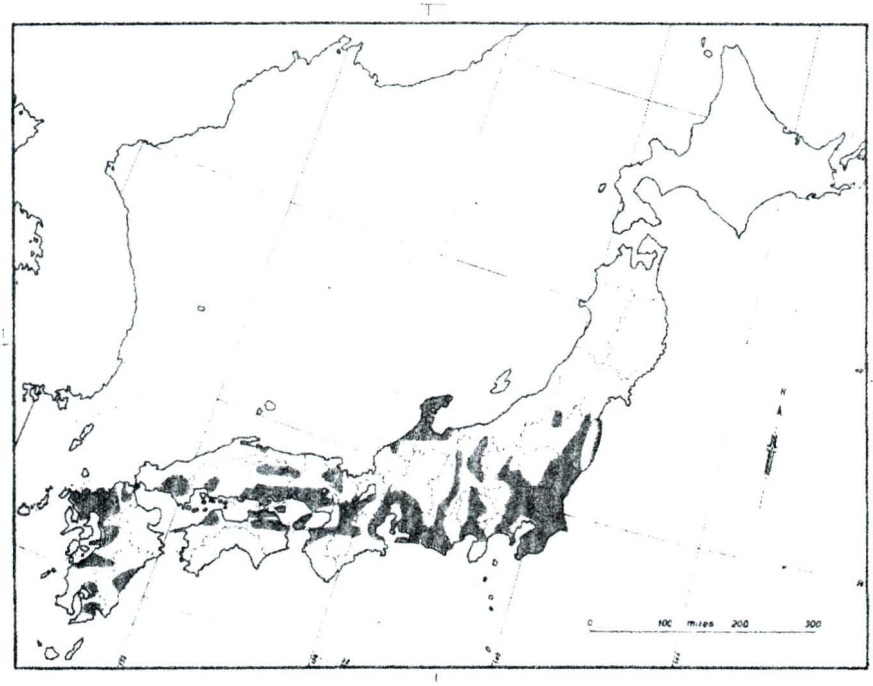
A. predominantly industrial areas.

B. areas with a high standard of living.

C. areas with a high population density.

D. areas with a high agricultural productivity.

19. _____



20. Where is the proportion of young adults highest in Japan today?

A. In rural areas.

B. In areas with the most pleasant climates.

C. In the large cities.

D. In small towns.

20. _____

21. Which of the following is true about farms in a subsistence economy?

A. Farm labor is usually drawn from the cities.

B. Farms are highly mechanized.

C. Each farm has only one major product.

D. Each farm produces only enough for its own consumption.

21. _____

22. Which of the following played the least important role in raising the standard of living in Japan?

A. New port and rail facilities.

B. New colleges and universities.

C. Foreign engineers and technicians.

D. Expanded foreign trade.

22. _____

23. For which of the following would most of the land in a city be used?

A. Commercial buildings

B. Industrial buildings

C. Residential buildings

D. Streets and highways

23. _____

24. Indicate whether each of the statements that follow best describe Mitaka, Niiike, or neither. Use M for Mitaka, K for Niiike, and X for neither.

A. Rapid growth in recent years _____

B. Good transportation links to a large city _____

C. Has farmhouses on separate farmlands _____

D. Workforce is composed of the old and women _____

25. For Japan, which of the following statements best describes the relationship between average temperature and degrees north latitude?

A. As latitude increases, temperature decreases

B. As latitude increases, temperature stays the same

C. As latitude increases, temperature increases

D. As latitude increases, temperature increases and then decreases

25. _____

26. Modernization of Japan resulted chiefly from

A. The decision of the government to modernize

B. The movement of population from rural to urban areas.

C. The discovery of valuable mineral deposits in Japan.

D. The rapid expansion of transportation facilities.

26. _____

27. The most important climatic factor with respect to type of crops grown in Japan is

A. rainfall

B. temperature

C. latitude

D. altitude

27. _____

28. Which of the following trends would you <u>least</u> expect to find occurring in a country that is shifting from an agricultural to an industrial economy?

A. Increasing migration from rural to urban areas

B. Increased mechanization on the farms

C. Growth of foreign trade

D. Decreased agricultural productivity

28. _____

29. The following figures are percentages of the total population in Japan for four areas in the years 1950, 1955, and 1960. Which area is most likely to be an urban area?

	1950	1955	1960
A.	1.0	0.9	0.8
B.	1.1	1.0	0.9
C.	7.5	9.0	10.4
D.	3.0	3.5	2.6

29. _____

30. Which of the following is most likely to lead to the largest increase of population for a city?

A. Establishment of recreation centres

B. Introduction of a chain of shopping centres

C. Construction of a steel plant

D. Improvement of the central business district

30. _____

31. Over the last hundred years in Japan

A. there has been a large scale migration from the metropolitan centres of Japan to the metropolitan centres.

B. there has been a large scale migration from the agricultural regions of Japan to the metropolitan centres.

C. the birth rate has greatly increased in the metropolitan centres of Japan but not in the agricultural regions.

D. the birth rate has greatly increased in the agricultural regions of Japan but not in the metropolitan centres.

31. _____

32. In which occupations would you expect most people in a large urban area to be employed?

A. Manufacturing and agriculture

B. Agriculture and commerce

C. Commerce and manufacturing

D. Commerce and services

32. _____

33. Which one of the following is <u>not</u> one of the five major urban areas of Japan?

A. Shimonoseki-Kitakyushu and Fukuoka

B. Nagoya

C. Okayama

D. Kyoto

E. Tokyo-Yokohama

33. _____

34. What relationships can you find between 2 major highways and land-forms on the attached map sheet of Niike?

_____

_____

_____

35. What relationship can you find between farm villages and land-forms on the attached map sheet of Niike?

_____

_____

_____

_____

36. What relationship can you find between rice fields and land-forms on the attached map sheet of Niike?

_____

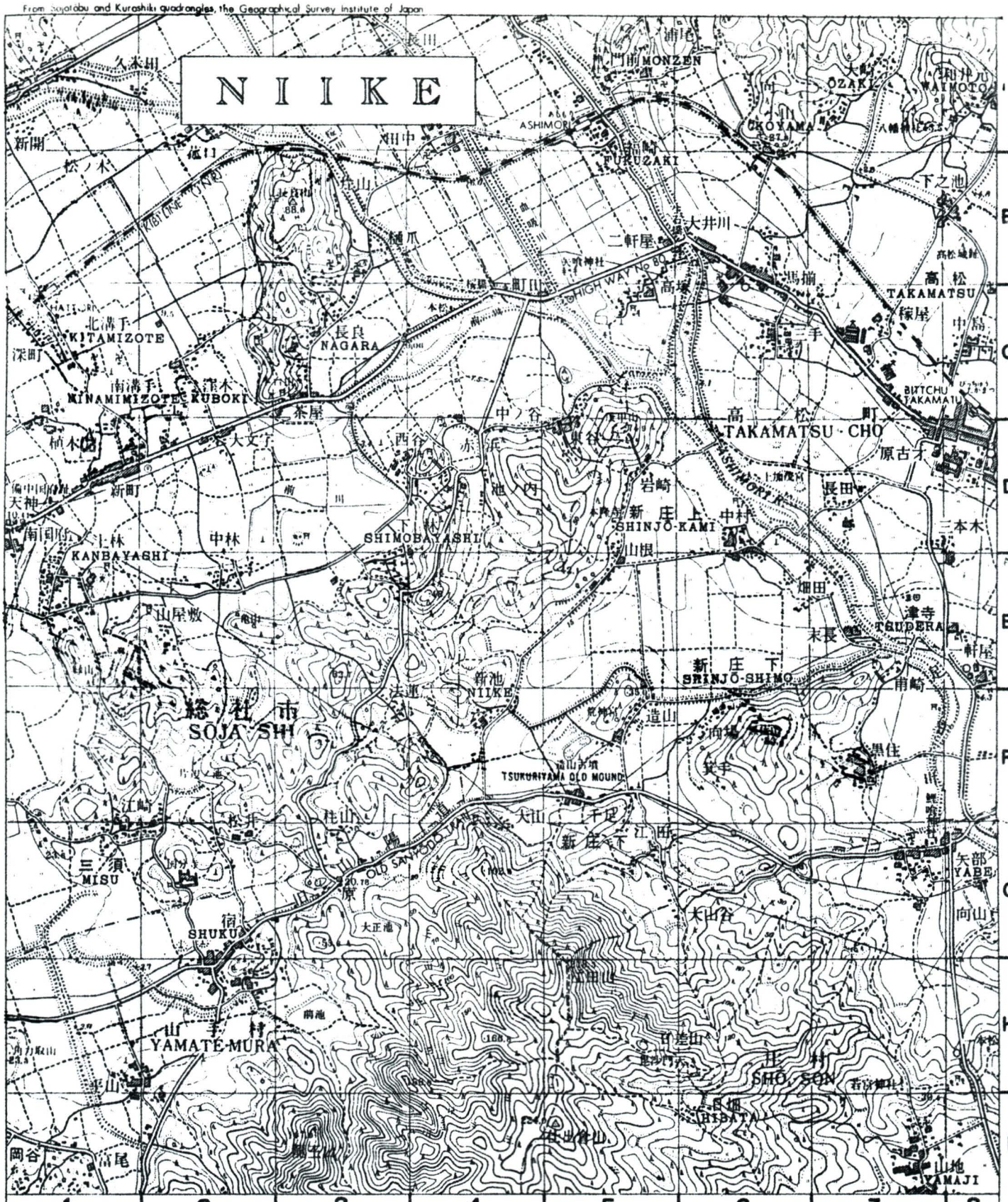
_____

_____

_____

From Soyotobu and Kurashiki quadrangles, the Geographical Survey Institute of Japan

NIIKE



- wall
- cemetery
- survey control point
- spot elevation
- bench mark
- shinto shrine
- buddhist temple
- isolated needleleaf tree
- school
- post office
- hospital
- town or village office
- bridge
- national highway
- prefectural highway
- road
- small lane
- power line
- county or city boundary
- town or village boundary
- needleleaf forest
- broadleaf forest
- bamboo grove
- orchard
- wasteland
- rice field, dry
- rice field, irrigated

Intermediate contour interval is 10 m

1 : 25,000

SURVEYED IN 1902, MODIFIED IN 1959

2 KILOMETER

0 ½ MILE

Approved by the Geographical Survey Institute. Drafted by T. Mori. Printed in Japan.

37. The most certain indicator of overpopulation in a country is

A. the use of birth control measures.

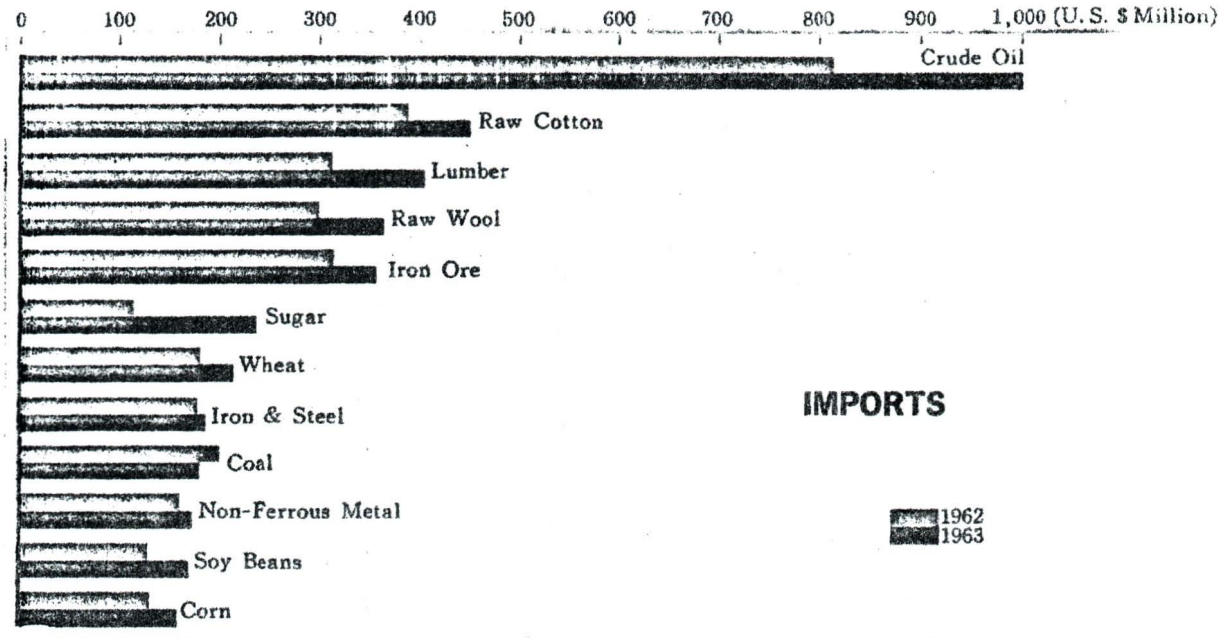
B. a high density of population.

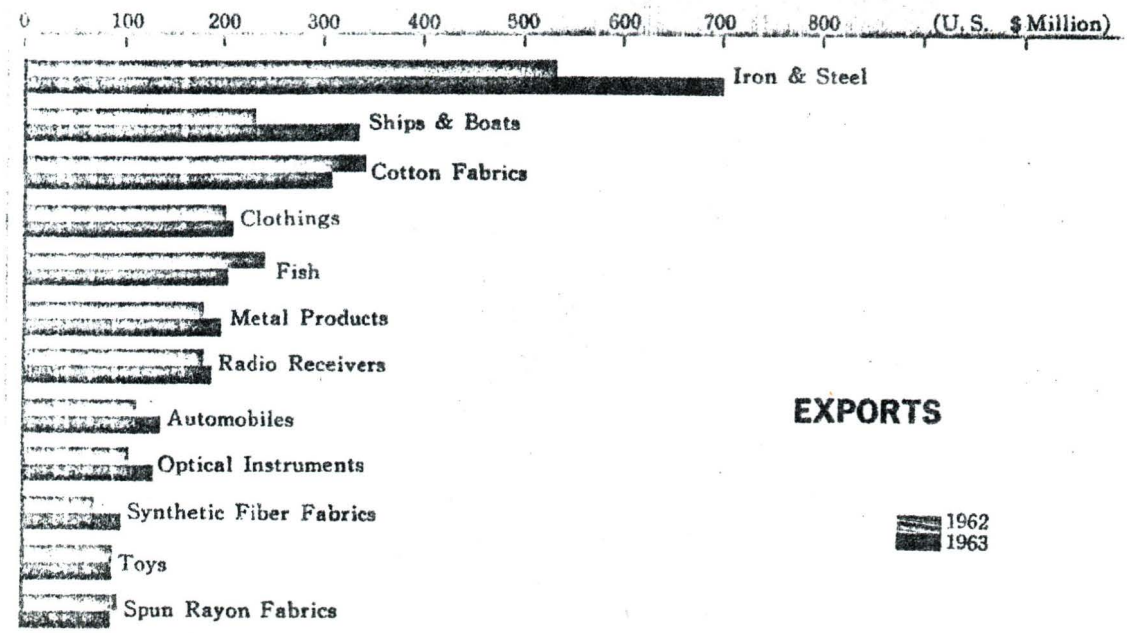
C. large scale food imports.

D. widespread famine.

37. _____

JAPAN'S FOREIGN TRADE BY PRINCIPAL COMMODITIES: 1962 and 1963





Questions 38, 39, and 40 refer to the graphs "JAPAN'S FOREIGN TRADE TRADE BY COMMODITIES: 1962 and 1963".

38. Which one of the following statements best describes Japan's foreign trade?

A. Imports raw materials and exports finished goods

B. Exports raw materials and imports finished goods

C. Imports approximately the same volume of raw materials and finished goods

D. Exports approximately the same amount of raw materials and finished goods

38. _____

39. The graphs show that Japan imports more than it exports in terms of total value (U.S. $ Million). How would you explain this difference?

_____

_____

_____

_____

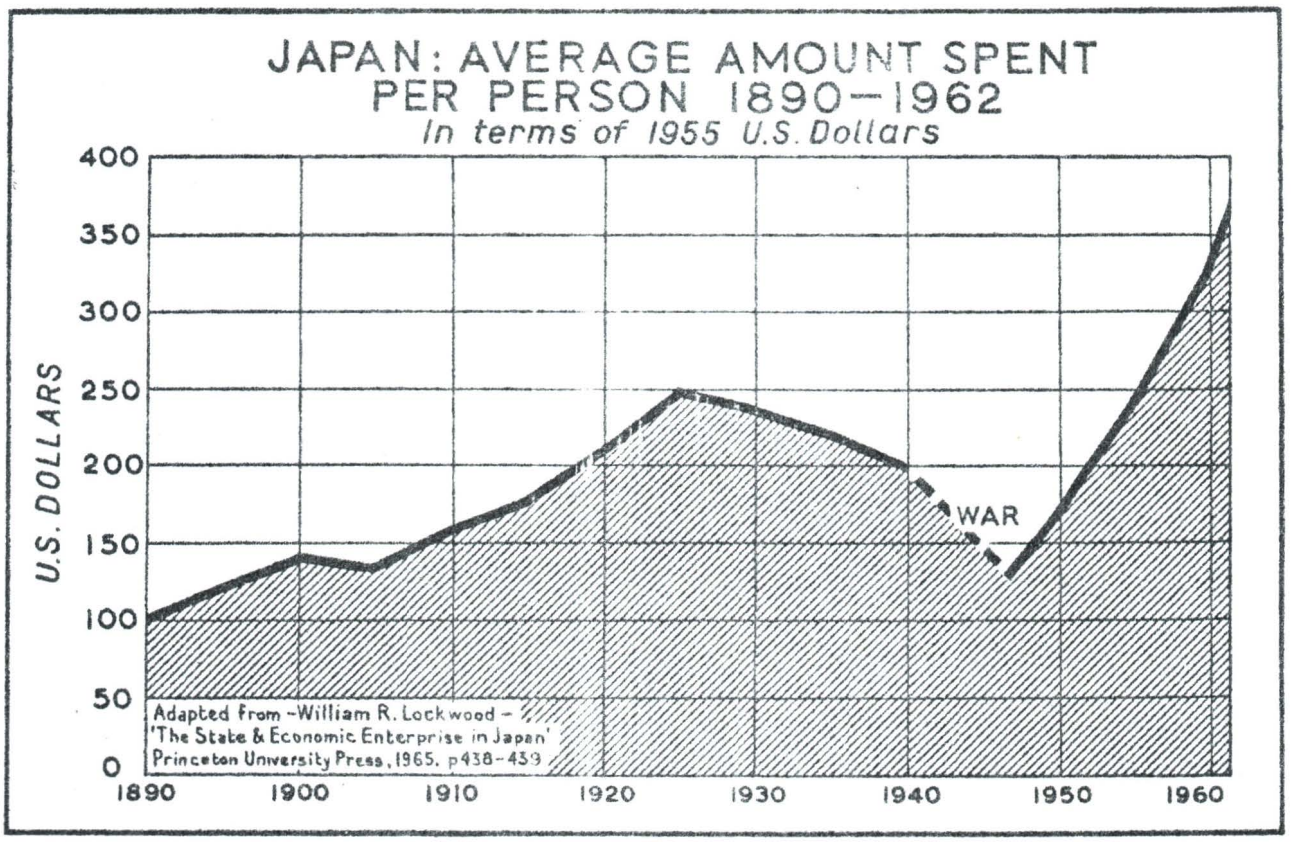
40. State one relationship that you can find between the amount of imports and exports for 1962 and 1963.

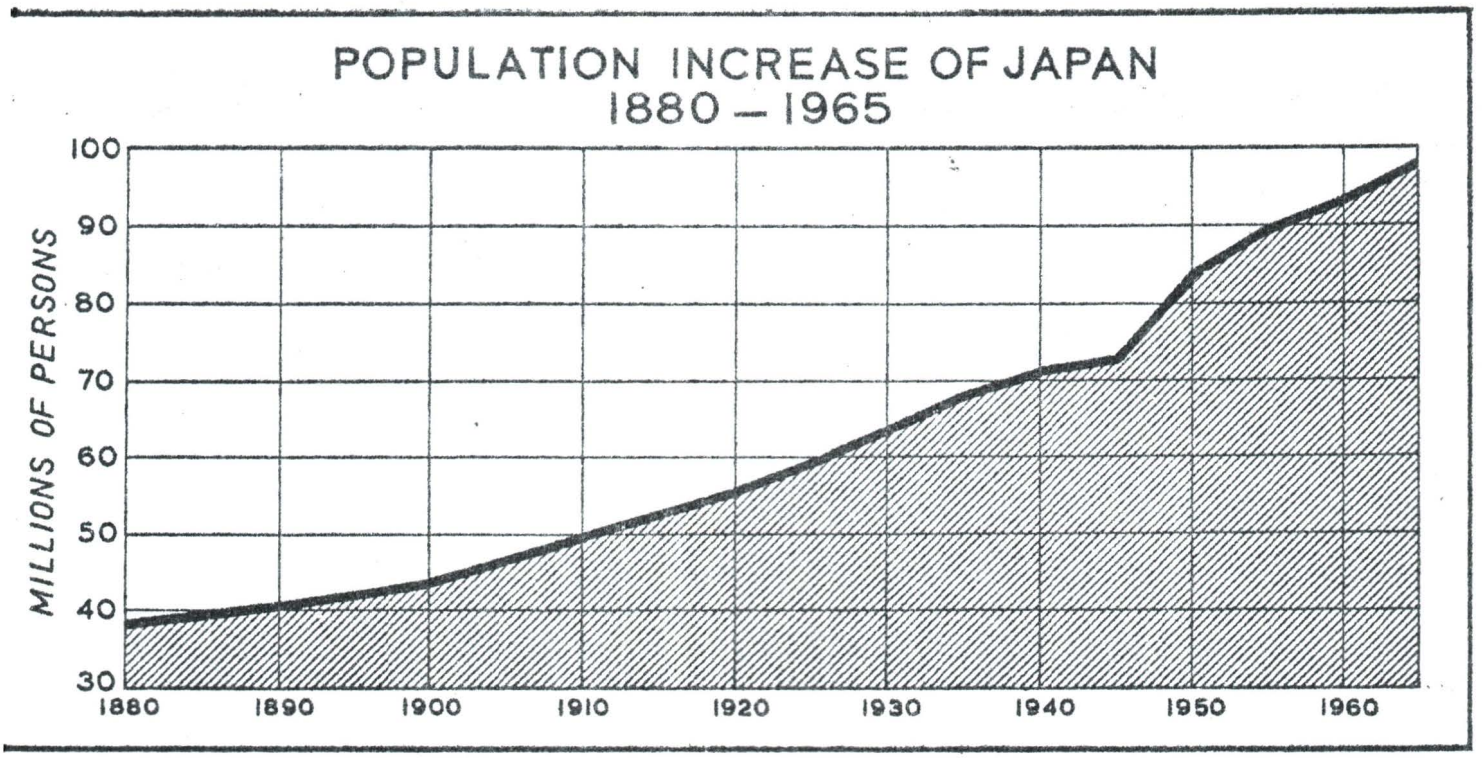
_____

_____

_____

Questions 41, 42 and 43 refer to the two attached graphs: (a) "JAPAN: AVERAGE AMOUNT SPENT PER PERSON 1890-1962" and (b) "POPULATION INCREASE OF JAPAN 1880-1965".


JAPAN: AVERAGE AMOUNT SPENT
PER PERSON 1890–1962
In terms of 1955 U.S. Dollars
U.S. DOLLARS
400
350
300
250
200
150
100
50
0
WAR
Adapted from –William R. Lockwood –
'The State & Economic Enterprise in Japan'
Princeton University Press, 1965. p438–439
1890
1900
1910
1920
1930
1940
1950
1960


POPULATION INCREASE OF JAPAN
1880 – 1965
MILLIONS OF PERSONS
100
90
80
70
60
50
40
30
1880
1890
1900
1910
1920
1930
1940
1950
1960

41. According to the two graphs, the overall increase in the standard of living between 1890 and 1960 has been

A. considerably greater than the increase in population.

B. considerably less than the increase in population.

C. approximately the same as the increase in population.

D. slightly less than the increase in population.

41. _____

42. As depicted by the graphs, the population between 1880 and 1965 increased by approximately

A. 2 times.

B. 2½ times.

C. 3 times.

D. 3½ times.

42. _____

43. If the trends depicted in the graphs continue

A. the amount spent and the population will continue to increase.

B. the amount spent will continue to increase and the population will level off.

C. the population will continue to increase and the amount spent will level off.

D. the amount spent and the population will level off.

43. _____

Questions 44, 45, 46 and 47 refer to the attached photograph.

44. Which of the following statements is supported by the photograph?

A. Agriculture in Canada is similar to that in Japan.

B. Japanese farmers are better farmers than are Canadian farmers.

C. Soil in Japan is more fertile than is soil in Canada.

D. Japanese farmers apply more labor to and make more intensive use of their farmlands than do Canadian farmers.

44. _____

45. From the photograph you can tell that this region

A. gets very little rain.

B. is irrigated.

C. has flood hazards.

D. is poorly drained.

45. _____

46. State the season at which this photograph was taken and then state the clues that support your inference.

Season: _____

Clues: _____

_____

_____

47. State one relationship between agriculture in Japan and climate that is evidenced in this photograph.

_____

_____

_____

NAME: _____ SEX: M or F School: _____
(surname first)
Division: _____

HIGHER-LEARNING TEST

Directions: Unless otherwise indicated, you are to select the answer or completion which is best and then write its corresponding letter in the answer blank on the right.

Example:

1. Victoria is a

   A. state
   B. city
   C. country
   D. continent

SAMPLE ANSWER

1. B

Time -- 45 minutes

DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO.

1. Which of the following statements do the graphs below best support?

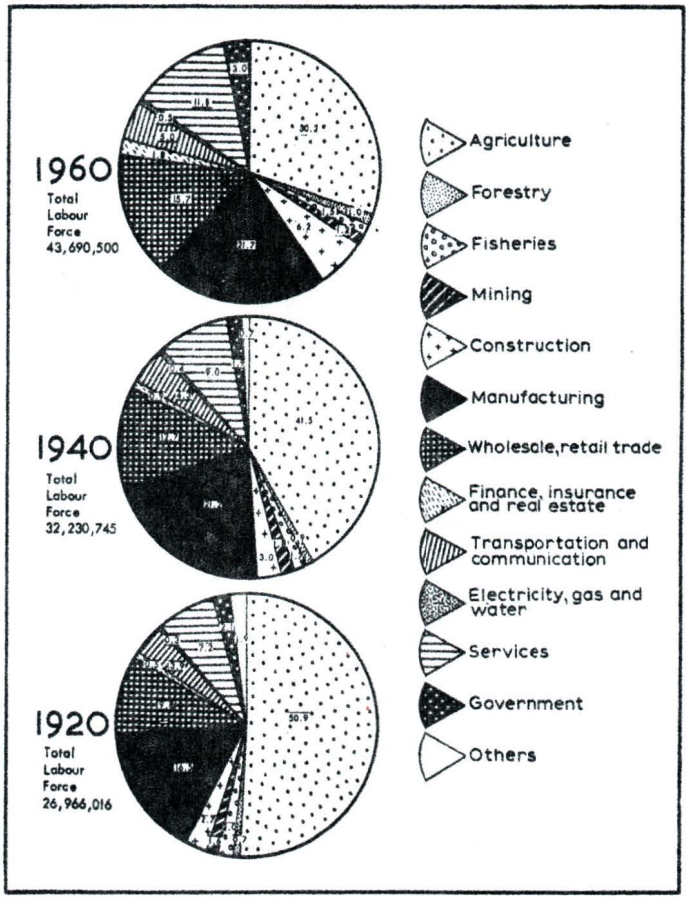
   A. There are fewer people in the labour force today than 50 years ago.

   B. there is a greater percentage of people involved in agriculture and forestry today than 50 years ago.

   C. Far more kinds of jobs are available today than were available 50 years ago.

   D. The number of jobs in wholesale and retail trade have increased in the last 50 years.

1. _____



OCCUPATIONAL STRUCTURE OF LABOR FORCE

2. Using the same graphs as in number 1, make a statement about changes that have probably occurred since 1920 with respect to each of the following aspects of the country represented by the graphs. After each of your statements list the evidence that the graphs offer to support your answer or hypothesis.

   1. Aspect: Percentage of population in rural areas.

      Statement: _____

      _____

      Evidence: _____

      _____

   2. Aspect: Total population.

      Statement: _____

      _____

      Evidence: _____

      _____

   3. Aspect: Standard of living.

      Statement: _____

      _____

      Evidence: _____

      _____

3. If you were attempting to estimate the average value of the housing in a particular neighborhood of a city, which of the following would be most useful as an aid?

   A. A topographic map of the area.

   B. An aerial photograph of the area.

   C. A graph comparing the number of people in the neighborhood to the number of people in similar sized areas of the city.

   D. A graph of the racial composition of the area.

3. _____

Graphs on which of the following topics would be most useful in determining whether a nation is suffering from population pressure? (Questions 4, 5, 6, and 7)

4. A. Birth rate

   B. Death rate

   C. Number of famines this century

   D. Amount of grain consumed per person per year

4. _____

5. A. Number of people employed in agriculture

   B. Number of people employed in manufacturing

   C. Per cent of population employed in industry and commerce

   D. Per cent of population employed in mining and forestry

5. _____

6. A. Number of people in the country in 1950 and today

   B. Density of population in the various divisions of the country

   C. Per cent of babies who die each year

   D. Per cent of children in labour force

6. _____

7. A. Per cent of population living in cities

   B. Per cent of family income spent on food

   C. Per cent of family income paid in taxes

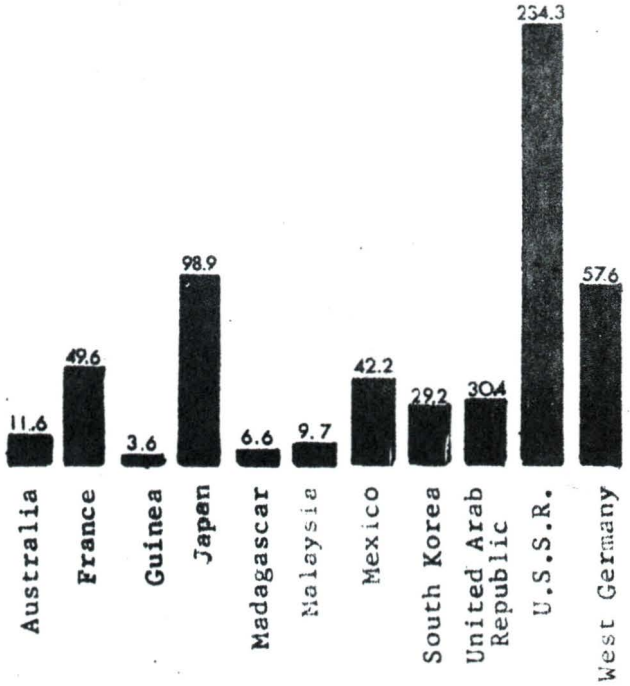
   D. Per cent of population under 21 years old

7. _____

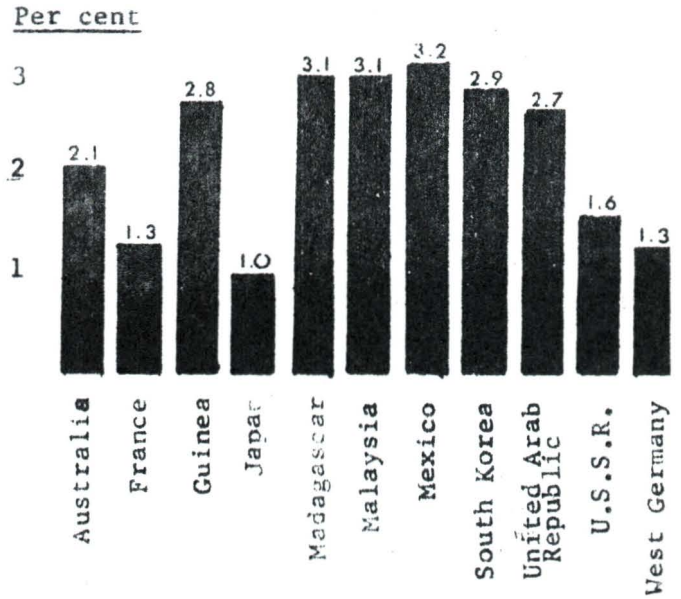
Questions 8, 9, 10, and 11 refer to the attached graphs on population and income. Study the graphs carefully before attempting the questions.

lions

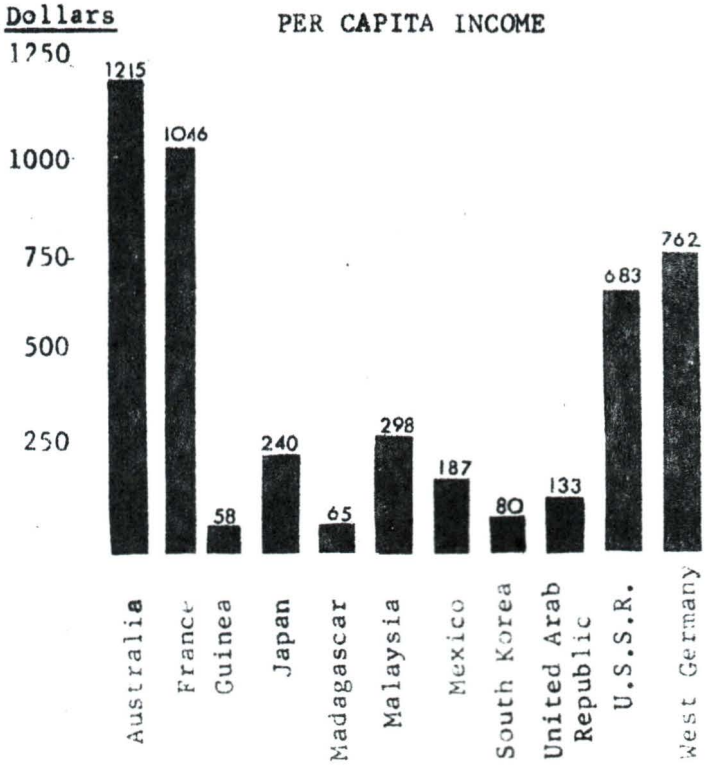
POPULATION IN MILLIONS



POPULATION INCREASE PER YEAR



PER CAPITA INCOME



8. In which areas is hunger most likely to become a serious problem?

   A. Mexico and Madagascar

   B. France and the U.S.S.R.

   C. Japan and South Korea

   D. Guinea and Australia

8. _____

9. In which area is hunger likely to be a less serious problem in the future?

   A. Guinea

   B. United Arab Republic

   C. Mexico

   D. Japan

9. _____

10. The graphs offer evidence to support which of the following statements?

   A. The population of the large nations is increasing faster than that of the small nations.

   B. The population of the European nations in increasing faster than that of the Asian nations.

   C. The population of the less wealthy nations is increasing faster than that of the wealthy nations.

   D. All nations grow in population at about the same rate.

10. _____

11. In order to help you better anwer question 9, which of the following additional graphs would be most useful?

   A. Average annual rainfall

   B. Average kilowatts of electricity per person

   C. Air pollution index

   D. Per cent of adults literate

11. _____

12. What would you expect to happen to a South American nation that is in the process of industrializing? Complete the following phrases indicating: 1. what will probably happen as the nation industrializes; and 2. why this will happen.

A. 1. Many people in the rural area will _____

_____

2. This will happen because _____

_____

B. 1. Trade will _____

_____

2. This will happen because _____

_____

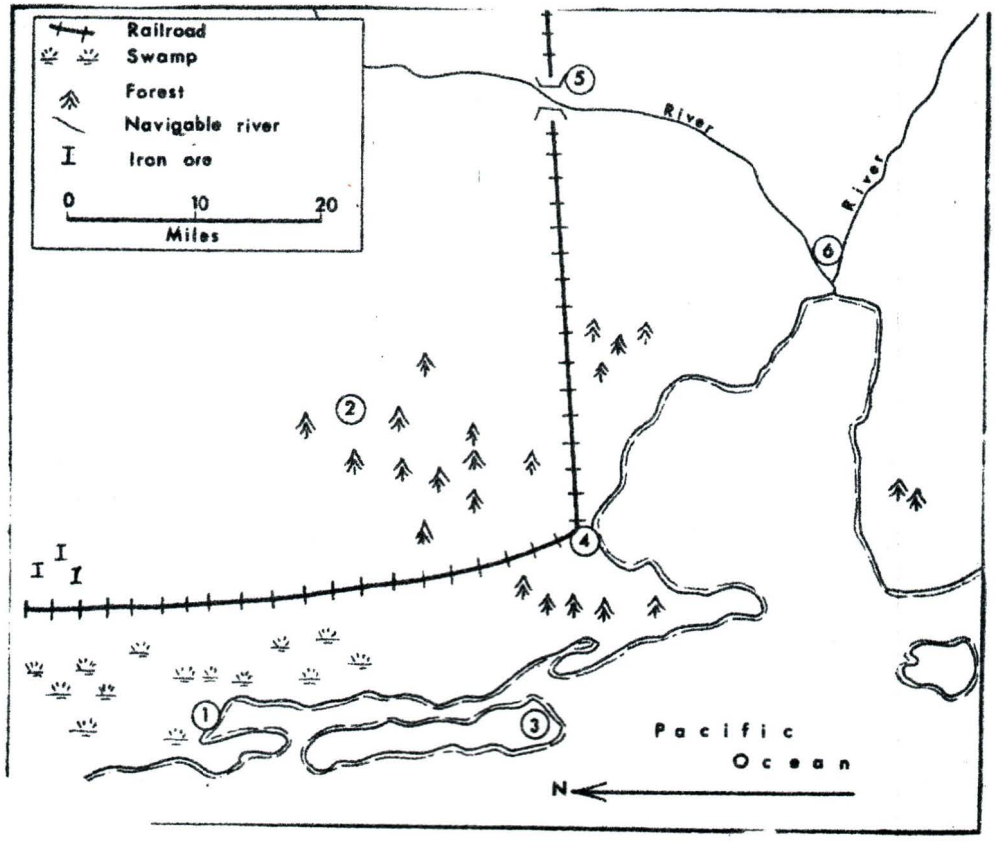
C. 1. The standard of living will _____

_____

2. This will happen because _____

_____

Questions 13, 14, 15, 16, and 17 are based on the following map of an imaginary area:



13. What advantage would a settlement located at 4 be likely to have over a settlement located at 6?

A. More transportation routes to the interior

B. Greater protection from storms

C. A more defensible position against attack by land or sea

D. Easier access to natural resources

13. _____

14. Number 2 would probably NOT be a good location for a settlement because of its

A. seasonal storms

B. lack of nearby farm land

C. distance from transportation routes

D. location near a large swamp

14. _____

15. Which of the following is the most reasonable argument against number 1 as a choice for a future large settlement?

A. It is probably without connections to the outside world

B. It is probably unhealthy and uncomfortable

C. It is probably indefensible

D. It is probably unprotected from storms

15. _____

16. Which location probably has the best chance of becoming a large city?

A. 2

B. 3

C. 4

D. 6

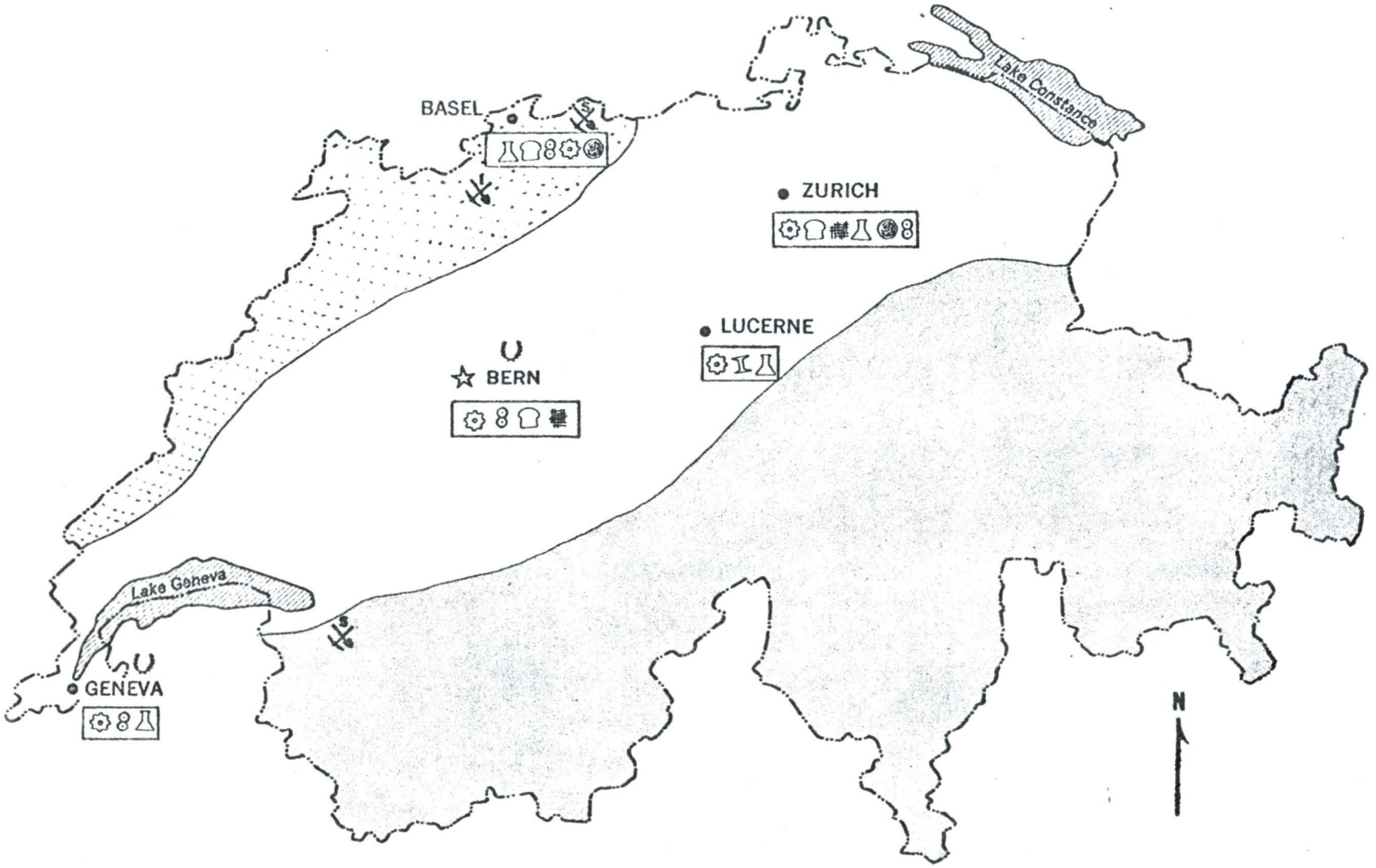
16. _____

17. Write a brief statement to support your choice in question 16.

_____

_____

_____



LEGEND

MANUFACTURING

- Chemicals
- Food Products
- Iron and Steel
- Printing and Publishing
- Machinery
- Textiles
- Wood Products

MINING

- Iron Mining
- Salt Mining
- National Capital
- Major City
- International Organizations

Scale: 0 10 20 30 40 Miles

LAND USE

- Forested Mountains and Pastureland
- Dairying, Vegetables, Fruit, and Wheat
- Mountain Area, Hay, and Pastureland
- National Boundary

Questions 18, 19, 20 and 21 refer to the attached map "Economy of Switzerland."

18. The main purpose of this map is to show

A. where there are mountains in Switzerland

B. where the people live in Switzerland

C. what the people of Switzerland do to earn a living

D. the national boundaries of Switzerland

18. _____

19. According to the map, most of the land in Switzerland is

A. covered with forests

B. used for dairy farming

C. mountain area

D. used for mining and manufacturing

19. _____

20. An important reason that wood products are manufactured in Basel is probably

A. the city is located in the forest area

B. mountains surround the city

C. there is little farmland

D. no other city in Switzerland manufactures wood products

20. _____

21. After studying the map, you would probably be correct in saying that

A. mining is very important in Switzerland

B. farming is of very little importance in Switzerland

C. most of the Swiss people earn their living from farming and manufacturing

D. more people work on dairy farms than in factories

21. _____

Question 22 is based on the following table which offers information about the Canadian trade relations with one foreign country from 1961 to 1963. All figures given are for EXPORTS from Canada to the foreign country.

	1961		1962		1963	
	Tons	U.S.$ '000	Tons	U.S.$ '000	Tons	U.S.$ '000
Grand total		265,772		254,997		318,799
(Exchange payments)		(241,523)		(195,964)		(248,032)
Wheat	1,459,086	102,782	1,206,642	89,219	1,303,032	100,577
Wheat flour	31,113	2,897	17,250	1,721	8,418	789
Bran	5,875	363	10,112	632	4,277	269
Raw hides	5,192	2,355	3,647	1,833	3,491	1,451
Flaxseed	104,340	14,484	80,877	12,076	97,021	13,079
Other oilseeds	24,276	3,076	41,489	4,706	82,230	10,213
Synthetic rubber	5,156	3,943	4,841	3,627	5,471	3,926
Lumber	.....	9,722	.....	14,759	.....	24,201
Dissolving pulp	5,482	1,020	13,084	2,248	24,190	4,204
Papermaking pulp	13,257	1,862	36,513	4,561	115,119	14,659
Asbestos	83,135	13,934	69,483	11,213	69,113	10,195
Iron ore ('000 tons)	1,115	16,751	1,574	23,721	1,886	27,167
Iron scrap	350,200	19,184	124,883	6,526	155,707	6,844
Copper ores	14,830	1,625	128,781	18,826	212,670	31,443
Nickel ores	15,936	2,068	24,513	3,271	19,679	2,612
Brass and bronze scrap	5,618	2,992	3,811	1,999	5,670	2,746
Aluminum scrap	5,251	2,583	3,685	1,512	4,390	1,735
Coal	626,656	9,509	558,316	8,729	689,524	10,255
Semi-coking coal	33,139	505	77,432	1,288	171,180	2,560
Beef tallow	3,700	667	9,367	1,326	10,290	1,567
Medicines and pharmaceuticals	.....	671	.....	1,164	.....	609
Artificial plastics	.....	.....	3,787	155	238,832	9,679
Iron steel	69,076	4,539	15,695	985	2,398	115
Copper and copper-alloys	11,413	7,545	2,232	1,498	76	72
Nickel and nickel-alloys	negligible	3	946	1,774	120	243
Aluminum and aluminum-alloys	21,076	10,663	12,950	6,401	16,874	8,391
Electronic computers	.....	.....	.....	4,123	.....	4,809
Statistical and accounting machines of punchcard system	.....	.....	.....	4,108	.....	4,054

22. Read each of the statements below and in the blank after each insert the letter:

A. if the information given in the table is sufficient for a judgement that the statement is definitely true.

B. if the information given in the table is sufficient only to indicate that the statement is probably true.

C. if the information given in the table is not sufficient to indicate any degree of truth or falsity in the statement.

D. if the information given in the table is sufficient for a judgement that the statement is definitely false.

1. the foreign country has an industrial economy 1. _____

2. Canadian exports to the country decreased in 1962 because of a general slowdown in the growth rate of the country's economy 2. _____

3. the foreign country buys primarily manufactured goods from Canada 3. _____

4. the total value of Canadian sales to the foreign country has steadily increased since 1961.

4. _____

5. Since 1961, the foreign country has developed its own flour milling industry

5. _____

6. sales to the foreign country in 1964 will increase greatly

6. _____

7. the future will see the sale of more Canadian finished goods to this country and a decrease in the sale of Canadian raw materials

7. _____

23. Which of the following sources of information would be most useful in determining the importance of the foreign country referred to in question 22 to Canadian sales?

A. Projected future population figures for the foreign country

B. Total values of all Canadian exports for 1961, 1962, and 1963

C. Number of people in Canada employed in activities directly related to exports to this foreign country

D. Total values of all Canadian production for 1961, 1962, and 1963

23. _____

Questions 24, 25, 26, and 27 refer to the map "Movements of Major Products on the Great Lakes". Study the map carefully before attempting to answer the questions.

MOVEMENT OF MAJOR PRODUCTS ON THE GREAT LAKES

LEGEND

Scale of Miles

0 50 100 150

Wheat

Iron Ore

Coal

Manufactured Products

24. By studying the map, you can tell that a large amount of wheat is grown near

A. Duluth and Fort William

B. Buffalo and Cleveland

C. Hamilton and Toronto

D. Milwaukee and Green Bay

24. _____

25. Which of the following products would you expect to see being loaded on the ships at Cleveland?

A. Food products

B. Coal

C. Iron Ore

D. Manufactured goods

25. _____

26. Most of the ships that go through the Welland Canal probably carry products from

A. farms and factories.

B. mines and factories.

C. mines and farms.

D. farms, mines and factories.

26. _____

27. Which of these statements about shipping on Lake Michigan is supported by the map?

A. Wheat and iron ore are shipped to the lake ports, and manufactured products are shipped out.

B. Coal and manufactured products are shipped to the lake ports, and wheat and iron ore are shipped out.

C. Iron ore and coal are shipped to the lake ports, and manufactured products are shipped out.

D. Manufactured products and wheat are shipped to the lake ports, and iron ore and coal are shipped out.

27. _____

28. In the following items you are to judge the effects of a particular occurrence on the standard of living of a country. In each case assume that there are no other changes in the country which would counteract the effect of the occurrence described in the item.

Mark the item:

A - if the policy described would reduce the standard of living.

B - if the policy described would increase the standard of living.

C - if the policy described would have no effect, or an effect that can not be determined on the standard of living.

1. An increase in population ..... 1. _____

2. An increase in trade outlets ..... 2. _____

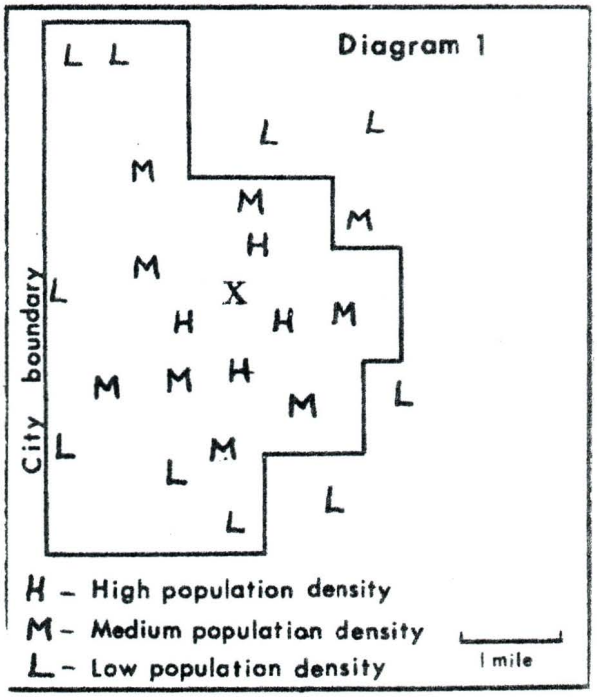
3. An increase in literacy ..... 3. _____

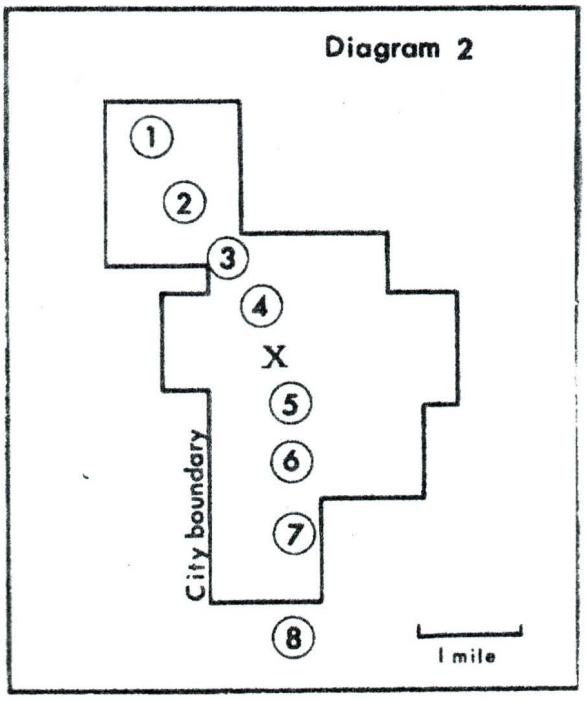
4. An increase in industrialization ..... 4. _____

5. An increase in rural population ..... 5. _____

6. An increase in food costs ..... 6. _____

Questions 29, 30 and 31 are based on the following diagrams of an imaginary city. The X on each diagram represents the city's central business district.





29. Where in Diagram 1 would you expect to find the highest percentage of new homes?

A. Near X

B. Near the H's

C. Near the M's

D. Near the L's

29. _____

30. If comparatively high income people live at point 3 in Diagram 2 and comparatively low income people live at point 6, at which of the following points are high income people most likely to be living?

A. Point 1

B. Point 5

C. Point 7

D. Point 8

30. _____

31. If you had a hunch that cities grow from the centre outwards in all directions at about the same rate of growth, which of the following would tend to support your choice?

A. Diagram 1

B. Diagram 2

C. Both Diagrams 1 and 2

D. Neither Diagram 1 nor 2

31. _____

Study the attached maps of Australia and then select the best completion or answer to questions 32, 33, 34 and 35.

32. Most of the mixed farming is found

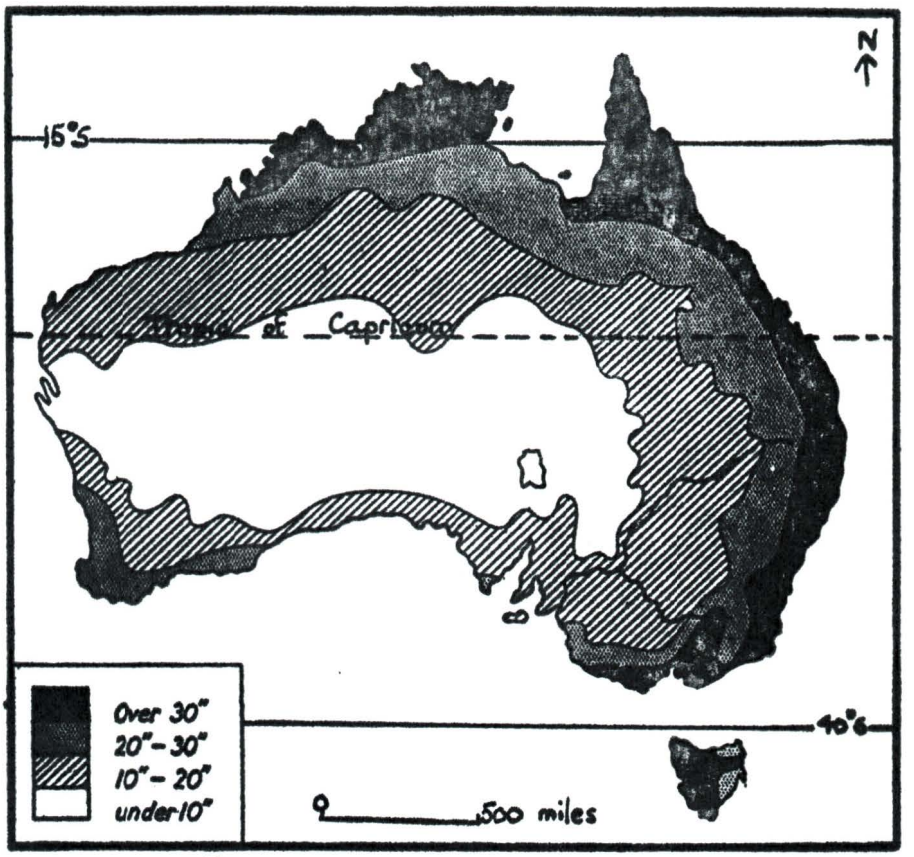
A. on the flat land

B. where the rainfall is heaviest

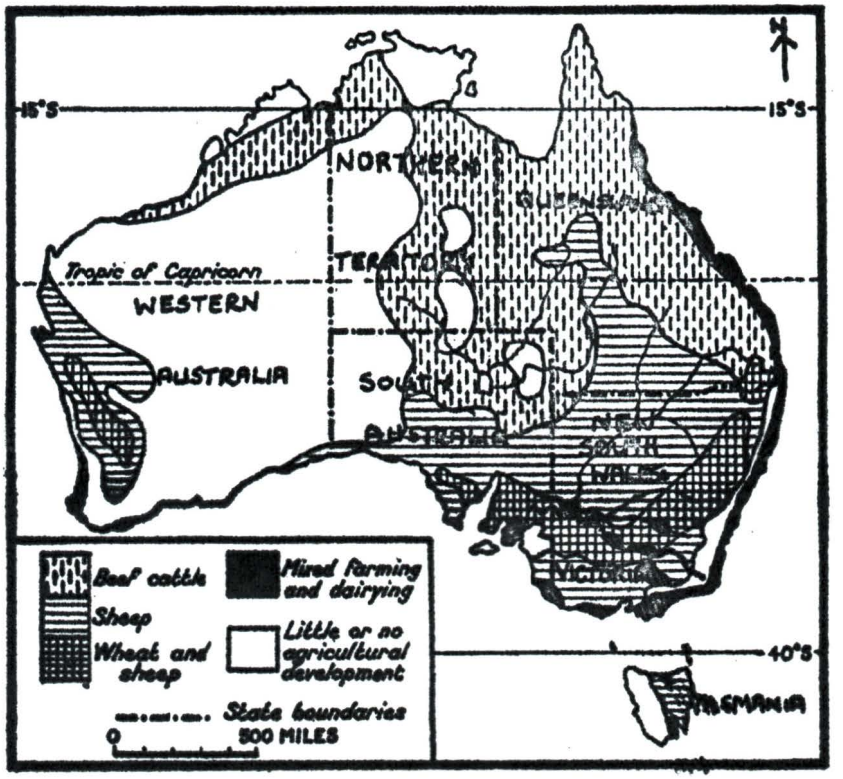
C. near the east coast

D. where the rainfall is moderate

32. _____



DISTRIBUTION OF RAINFALL IN AUSTRALIA.
(Amounts in inches per annum.)



AUSTRALIA: LAND USE

33. Most of Australia's agricultural land is devoted to

A. the raising of stock

B. fruit growing

C. growing wheat

D. mixed farming

E. dairying

33. _____

34. The most densely populated part of Australia is probably in

A. the sheep belt.

B. the beef cattle belt

C. the wheat and sheep belt

D. the mixed farming and dairying belt

E. the area of little or no agricultural development.

34. _____

35. Tropical crops requiring much warmth and rainfall would likely be grown

A. on the eastern coast of Queensland

B. in Tasmania

C. on the western coast of West Australia

D. in the interior of New South Wales

35. _____

36. After each of the following paired items relating to a developing country put:

A - if an increase in the first of the items referred to is likely to be accompanied by an increase in the second.

B - if an increase in the first of the items referred to is likely to be accompanied by a decrease in the second.

C - if an increase in the first of the items referred to is likely to have no appreciable effect on the second.

1. (a) trade with other countries
   (b) ability to support a larger population ..... 1. _____

2. (a) urban population
   (b) rural population ..... 2. _____

3. (a) improved agricultural technology
   (b) food production ..... 3. _____

4. (a) amount of rainfall
   (b) size of population ..... 4. _____

5. (a) transportation links to a city
   (b) size of that city ..... 5. _____

6. (a) mixed economic activities
   (b) urban population ..... 6. _____

Read the following passage and then complete question 37.

Farmers in parts of southern Nigeria use hoes instead of plows. The farmers produce crops mainly for food for their own families and not for cash income. Their families include distant relatives and are based on marriage customs different from ours. The soils are generally not fertile. As a result fields must be left idle for some time after a crop is harvested. Thus the farmers cultivate first one field and then another. There are no work animals because the tsetse fly brings a disease that kills work animals.

37. If you were called upon to give advice to the leaders of this underdeveloped nation in order to help them raise their nation's standard of living and to modernize, what advice would you give to them? You are limited to five statements of advice.

1. _____

_____

2. _____

_____

3. _____

_____

4. _____

_____

5. _____

_____

VITA

Surname: GRIEVE **Given Names:** TARRANCE DON

Place of Birth: TRAIL, B.C. **Date of Birth:** JUNE 27, 1941

Educational Institutions Attended, with Dates of Entering and Leaving:

UNIVERSITY OF VICTORIA, VICTORIA	1960	to 1961
UNIVERSITY OF VICTORIA, VICTORIA,	____	to ____
(Summer Sessions)	1962	to 1966
UNIVERSITY OF VICTORIA, VICTORIA	1966	to 1967

Degrees, Diplomas, Etc., Awarded, with Dates and Names of Institutions:

B.Ed. (with distinction)	1967	University of Victoria, Victoria

Honors and Awards:

University of Victoria Fellowship, 1967/68.

University of Victoria Fellowship, 1968/69.

Educational Research Institute of British Columbia Grant 1969.

Publications:

Grieve, T.D. Use of the National Research Council's Computor Aided Teaching System - An Initial Attempt. National Research Council of Canada, Ottawa, 1968.

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