# CHAPTER THREE

## TEST CONSTRUCTION

# C H A P T E R III

## TEST CONSTRUCTION

### 3.1.0 Introduction

To test the hypotheses relating to the creative thinking in geography and achievement in geography of eighth graders, tests were developed by the investigator. A Geography Achievement Test on the basis of Structure of Intellect Model (GATSI) was developed and standardised by the investigator in order to see the effect of the treatment upon creative thinking in geography of eighth graders. Three achievement tests in geography were developed in order to measure the effect of the treatment upon the achievement in geography of the eighth graders. In the following pages, details about the construction and standardisation of GATSI will be given under captions from 3.2.0 to 3.2.14 and the construction of achievement tests will be given under captions from 3.3.0 to 3.3.3.

### 3.2.0 Geography Achievement Test on Structure of Intellect Model (GATSI)

As discussed above the purpose of the test is to measure the creative thinking in geography of eighth graders. This test was developed on the lines of Guilford's (1956) Structure of Intellect model. Before describing the actual development of the test, it is necessary to describe in brief, the details

of Guilford's Structure of Intellect model in the following paragraphs.

3.2.1 The Factors of SI Model

Guilford (1956) explains his SI model with the possible 120 factors. Although each factor is sufficiently distinct to be detected by factor analysis, they resemble one another on three dimensions. Briefly, the first dimension of the model is operation. There are five operations namely, Cognition, Memory, Divergent Production, Convergent Production and Evaluation. Cognition means discovery or rediscovery or recognition. Memory means retention of what is recognised. The Divergent Production leads to many ways of finding the answers while convergent production leads to one right answer or to a recognised best or conventional answer. In evaluation, decisions are taken as to goodness, correctness suitability or adequacy of what we know, what we remember and what we produce in productive thinking.

The second dimension of the model is 'content', which is divided into four types, such as, Figural, Symbolic Semantic and Behavioural. Figural content is concrete material, such as, is perceived through the senses. Symbolic content is composed of letters, digits and other conventional signs usually organised in other general systems, such as, the alphabet or number system. Semantic content deals with the concepts, constructs and ideas. Behavioural content takes care of the kind of information involved in congnition and

in the other operations pertaining to the behaviour of the people. It has been added on the theoritical basis to represent the general area sometimes called the 'social intelligence'.

When a certain operation is applied to a certain kind of content, as many as six general kinds of products may be involved. This forms the third dimension of the model. These products are of six types, namely, Units, Classes, Relations, Systems, Transformations and Implications. A brief description about these products are given below.

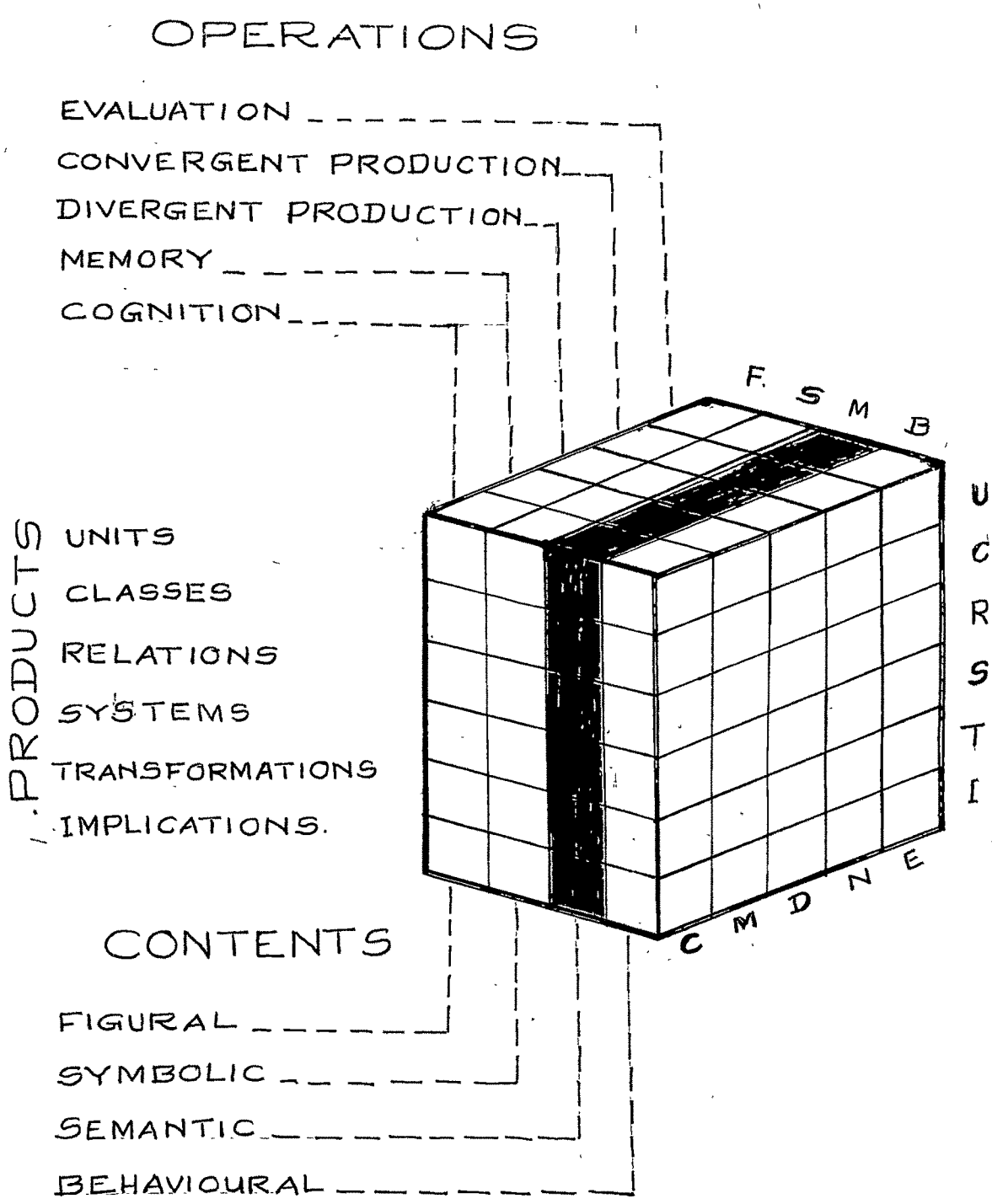
Unit: Unit is relatively segregated or circumscribed items or 'chunks' of information having 'thing' character.
Class: A class idea is a second kind of product having its own existence. Like most products other than units, it is transposable. A class can be embodied utilising different sets of particulars.
Relation: Relation is the ability to see the realtionships such as opposition, part-whole, agent-action, or anything being larger or softer than the other.
System: When rules, principles, orders, orientations and structures are talked about it is nothing but the psychological product of system.
Transformation: It may be anykind of a change, such as reddening, expanding, reversal, interchange and so on.
Implication: Like relation, implication is a connection between two units of information, but there is a difference. Relations are definable kinds of connections but implications

are sheer connections arbitrarily formed by circumstances of contiguity, frequency of occurance and the like. Implications come nearest to the traditional concept association.

Thus each cell in the model calls for a certain kind of ability that can be described in terms of operations, contents and products. The diagram 3.1 shows the 120 factors included in the Structure of Intellect Model.

Diagram 3.1

FACTORS OF SI MODEL




(Shaded part indicates the factors included in GATSI)

3.2.2 Studies Based on SI Model

In this connection it is fit to state that certain tests constructed on the lines of SI model are reported to be useful in measuring and predicting the achievement in different fields. Guilford and Hoepfner (1971) in their study based upon a battery of 16 SI ability tests and score variables from the U.S Coastal Guard Academy Aptitude Battery showed that the abilities of Cognition of figural transformation, Cognition of semantic unit, Divergent production of figural tansformation, Convergent production of symbolic relation, etc. (CFT, CMU, DFT, NSR, etc) had significant variance with Engineering, Physics, Analytical Geometry, Nautical astronomy, etc. They also report another study of predictive validity of SI model ability tests for achievement in higher Mathematics courses.

In India, very recently, the National Council of Educational Research and Training has developed a Scientific Creativity Test in order to help, in finding out the talented students for the scholarships under the National Science Talent Search Scheme, on the lines of SI model of Guilford. The potential twentynine factors of SI model of Guilford for finding out the science talent in children were included in the construction of the test item. Majumdar (1973) who worked for the NCERT's Scientific Creativity Test reported that scientific content from the areas of Physics, Chemistry,

Mathematics and Biology, keeping the psychological constucts of the above mentioned SI factor tests were included in the test. Besides the studies, having the test constructed based on the structure of intellct model of Guilford, certain other studies are found wherein some training programme was arranged for teachers based on the above model. Attington (1973) conducted a study to determine whether training into the application of Guilford's Structure of Intellect model could result in the following changes in class room behaviour of teachers: (i) a decrease in the proportion of time spent on routine tasks, (ii) a decrease in non essential teacher inputs, (iii) an increase of student divergent and convergent production, and (iv) an increase in the proportion of time students dealt with unit, class, relation, system, transformation and implication.

The result of the experiment was that after eight weeks of guided sessions the teachers had reduced their average routine time from 23 percent to seven percent, and their inputs from 44 percent to 20 percent. Then it had increased student's productive thinking time from 12 percent to 40 percent. In each of these cases the change was significant at .0001 level. It was also found that after having given an extra year for the control group when tested again the original score of the experimental students was still higher. The same study was replicated again and found with the same results.

From the perusal of the literature, it appears that

no attempt had been made to construct a test for measuring the divergent achievement in Geography on the basis of SI model test items for the secondary school children. In order to test the creative thinking in geography of the sample of this study, it was then decided to construct a Geography Achievement Test on the basis of SI model (GATSI).

Geography as a school subject includes the concepts and ideas in which words are maninly used. Creative thinking falls mainly under divergent production. According to Guilford (1968) creative thinking includes three fluencies (ideational fluency, associational fluency, and expressional fluency), two flexibilities (spontaneous flexibility and adaptive flexibility) originality, elaboration, sensitivity to problems, redefinition and penetration. The different definitions of creativity have been discussed under caption 1.3.0. Since the different mental abilities that contribute to creative thinking extend beyond divergent production of SI model, it was thought fit to construct a test incorporating the semantic content for the products and operations of SI model in geography.

### 3.2.3 Factors Included in the Present Test

Table 3.1 reveals the factors included in the test and their respective code letters. The diagram 3.2 shows the 30 factors that are taken into consideration in the present test from the SI model.

DIAGRAM 3.2

SEMANTIC (M) PRODUCTS FOR THE FIVE OPERATIONS OF SI MODEL

| | Cognition C | Memory M | Divergent production D | Convergent production N | Evaluation E |
|---|---|---|---|---|---|
| Unit U | CMU | MMU | DMU | NMU | EMU |
| Class C | CMC | MMC | DMC | NMC | EMC |
| RelationR | CMR | MMR | DMR | NMR | EMR |
| System S | CMS | MMS | DMS | NMS | EMS |
| Transformation T | CMT | MMT | DMT | NMT | EMT |
| Implication I | CMI | MMI | DMI | NMI | EMI |

TABLE 3.1 FACTORS INCLUDED IN THE TEST (GATSI) AND THEIR CODE

| S.No | Description of the products | Code |
|---|---|---|
| 1. | Cognition of semantic unit | CMU |
| 2. | Cognition of semantic class | CMC |
| 3. | Cognition of semantic relation | CMR |
| 4. | Cognition of semantic system | CMS |
| 5. | Cognition of semantic transformation | CMT |
| 6. | Cognition of semantic implication | CMI |
| 7. | Memory for semantic unit | MMU |
| 8. | Memory for semantic class | MMC |
| 9. | Memory for semantic relation | MMR |
| 10. | Memory for semantic system | MMS |
| 11. | Memory for semantic transformation | MMT |
| 12. | Memory for semantic implication | MMI |
| 13. | Divergent production of semantic unit | DMU |
| 14. | Divergent production of semantic class | DMC |
| 15. | Divergent production of semantic relations | DMR |
| 16. | Divergent production of semantic system | DMS |
| 17. | Divergent production of semantic transformation | DMT |
| 18. | Divergent production of semantic implication | DMI |
| 19. | Convergent production of semantic unit | NMU |
| 20. | Convergent production of semantic class | NMC |
| 21. | Convergent production of semantic relations | NMR |
| 22. | Convergent production of semantic system | NMS |

| S.No | Description of the products | Code |
|---|---|---|
| 23. | Convergent production of semantic transformation | NMT |
| 24. | Convergent production of semantic implication | NMI |
| 25. | Evaluation of semantic unit | EMU |
| 26. | Evaluation of semantic class | EMC |
| 27. | Evaluation of semantic relations | EMR |
| 28. | Evaluation of semantic system | EMS |
| 29. | Evaluation of semantic transformation | EMT |
| 30. | Evaluation of semantic implication | EMI |

In this regard, a brief description of the factors and the tests demonstrated and identified through factor analysis by Guilford and others is relevent. In 1956 when Guilford proposed his SI model only 40 factors were empirically demonstrated. From that date onwards the search for more demonstration are steady and until 1975, 98 factors have been demonstrated. The behavioural content comparatively proposed later by Guilford is still lacking ~~behind~~. All the factors of all other operations are already demonstrated not only once but many times and by different researchers. For each factor a number of types of tests were tried and factor analysed. It is to be stated here that all of them were of general type and the purpose mainly was to test the particular mental ability. In the present study the purpose was to test the

above mentioned semantic abilities in geography. Hence, it was decided to construct items of geography on those lines.

3.2.4 The Abilities that the Test Measures

Before the various test items were constructed, the actual abilities that are to be tested by this test are identified. Table 3.2 shows the particular Semantic product and its relevant mental ability, the test is proposing to measure.

TABLE 3.2 PRODUCTS AND THEIR MENTAL ABILITIES

| S.No | Products | Mental ability |
|---|---|---|
| 1. | CMU | Verbal comprehension |
| 2. | CMC | Verbal classification |
| 3. | CMR | Verbal analogies |
| 4. | CMS | General reasoning |
| 5. | CMT | Penetration |
| 6. | CMI | Concept foresight |
| 7. | MMU | Memory for ideas |
| 8. | MMC | Concept recall |
| 9. | MMR | Finding the relation with the definition |
| 10. | MMS | Learned information |
| 11. | MMT | Memory for word meaning |
| 12. | MMI | Memory for paired associates |
| 13. | DMU | Ideational fluency |
| 14. | DMC | Spontaneous flexibility |

| S.No | Products | Mental ability |
|---|---|---|
| 15. | DMR | Associational fluency |
| 16. | DMS | Expressional fluency |
| 17. | DMT | Originality |
| 18. | DMI | Elaboration |
| 19. | NMU | Location of central idea |
| 20. | NMC | Ability to see classes |
| 21. | NMR | Eduction of conceptual correlation |
| 22. | NMS | Ordering |
| 23. | NMT | Semantic redefinition |
| 24. | NMI | Attribute listing |
| 25. | EMU | Class specification from the list of possible answers |
| 26. | EMC | Class idea to be evaluated |
| 27. | EMR | Logical evaluation |
| 28. | EMS | Experimental evaluation |
| 29. | EMT | Production of answeres involving the interpretation of common objects |
| 30. | EMI | Sensitivity to problems |

### 3.2.5 Selection of Items

While selecting the types of test items for the present study, preference was given to items developed on the lines of Guilford (1967). Since the present test is meant for eighth grade students considerable thought was given in selecting the test items from the eighth grade geography course. A number of

goegraphy books were consulted for the preparation of the items for the test. Mainly the geography books for eighth grade, written based on the syllabi of Central School Organisation, Gujarat State Board of Secondary Education and Tamilnadu Government Text Book Committee were consulted. As said earlier the main concentration for the test items were on the eighth grade course. Yet some of the test items were also taken from the contents outside the eighth grade syllabus. But enough care was taken to restrict those selections only from the lowere class courses,such as, seventh, sixth and fifth grades whidh a geography student of eighth grade is expected to know. It was done like that for the following two reasons: (i) for testing the memory abilities, as memory forms one of the 'operations' of the test; and (ii) sufficient items satisfying to test the mental abilities mentioned above could not be easily constructed without overlap of items from eighth grade syllabus.

In this way, test itmes were prepared for all the 'products', such as, Units, Classes, Relations, Systems, Transformations, and Implications for the Operations of Cognition, Memory, Divergent production, Convergent production, and Evaluation. In preparing the items, to startwith, five items were tried for each product. If, in certain cases, it was not possible at the beginning to construct five items, they were for the time being kept in abeyance and items for the other products were tried. The left out items were again taken up in the second or third round as the case may be. In the construction of items for the memory products some difficulty was felt at first. The sample test items given by Guilford (1967) for memory products were more of numerical

and algebraic in nature. They could not be replicated in geography. Therefore, keeping in mind, the mental ability that the particular item is going to test and the items given by Guilford, the investigator constructed similar semantic items for the memory products. While constructing the items, at first each product was written in a separate sheet of paper. The available tests for testing the particular ability were noted down side by side. On the lines of the available tests, items in geography from eithth grade course were constructed. Many of the test items were developed on the lines of Guilford. For some of the items some deviations and modifications were made to suit the geography content. Table 3.3 shows the type of the test items constructed for each product.

TABLE 3.3 PRODUCTS AND THE NAME OF THE TESTS CONSTRUCTED FOR TESTING THEM

| S.No | Product | Name of the test items constructed |
|---|---|---|
| 1. | CMU | Definitions |
| 2. | CMC | Verbal classification (exclusive type) |
| 3. | CMR | Word matrix test |
| 4. | CMS | Necessary facts |
| 5. | CMT | Similarities |
| 6. | CMI | Pertinent questions |
| 7. | MMU | Test name recall type |
| 8. | MMC | Concept recall |

| S.No | Products | Name of the test items constructed |
|---|---|---|
| 9. | MMR | Remembered relations type |
| 10. | MMS | Learned information (system) |
| 11. | MMT | Memory for word meaning |
| 12. | MMI | Related alternative type |
| 13. | DMU | Consequences test |
| 14. | DMC | Various Uses test |
| 15. | DMR | Associational fluency |
| 16. | DMS | Descriptive completion |
| 17. | DMT | Remote association test |
| 18. | DMI | Planning elaboration |
| 19. | NMU | Word group naming |
| 20. | NMC | Word grouping |
| 21. | NMR | Inventive verbal relations |
| 22. | NMS | Sentence order |
| 23. | NMT | New uses |
| 24. | NMI | Attribute listing II |
| 25. | EMU | Double description |
| 26. | EMC | Class name selection |
| 27. | EMR | Matched verbal relations |
| 28. | EMS | Important facts |
| 29. | EMT | Product choice type |
| 30. | EMI | Inference |

It was decided to have two items for the divergent type questions and four items for the others for the preli-

minary test. Considering the nature and length of questions it was also decided to have only two items for NMC and EMI pooducts and three items for the CMI, NMT and EMS products. Thus the test at the preliminary stage was having 101 items. The selection of only two items for divergent questions was mainly made for two reasons: (i) There is no right or wrong answers for them, (ii) The scoring of these items require special techniques and also more time. Since there is no right or wrong answer all questions are of equal weightage provided all other characteristics are equal. Hence to avoid time consuming scoring process, it was decided only to have two divergent items in the preliminary test. The number of responses expected for questions was restricted to three uniformally, for it was considered easy for the students to write the answers and the investigator to score them.

3.2.6 Blue-Print

Sufficient care was taken in selecting the test items from the eighth and lower grade courses. The decided courses was divided into 17 concepts. To find out the nature of the dispersion of the 101 items, a blue-print was made. From that it was found that certain concepts were over represented with questions while certain others were under represented. To have a proper dispersion an attempt was again made to delete certain items from the over represented concepts. After the recasting, again a blue print was prepared and satisfied

with the dispersion of 30 main questions with 101 items in 17 concepts. Table 3.4 shows the number of test items constructed against each of the concepts.

TABLE 3.4 CONCEPTS AND NUMBER OF ITEMS SELECTED AGAINST EACH OF THEM (preliminary Test)

| S.No | Concepts | No of questions selected |
|---|---|---|
| 1. | Fall of sun's rays, measurement of temperature factors affecting temperature, Isotherms, Isothermal maps | 4 |
| 2. | Humidity and condensation, rainfall, relief, convection rain shadow, measurement of rain | 5 |
| 3. | Structure of earth, lithosphere, hydrosphere barrisphere, and atmosphere | 5 |
| 4. | Air pressure, pressure belts of world, barometer winds, permanent wind system of the world, trade and antitrade winds | 4 |
| 5. | Periodical winds, Monsoon, Fohn, Chinook, Typhoon, Tornodoes, cyclones and anticyclones | 7 |
| 6. | Rocks, volcanoes, distribution of volcanoes earthquakes | 4 |
| 7. | Ocean movements, waves, currents, warm and cold, effects of ocean currents on climate and navigation, tides, spring and neap tides | 7 |
| 8. | Earth sculpture denudation-transportation and deposition, action of rain, sun, frost, atmosphere, rivers, glaciers, winds, underground and sea water, climate determining factors, weather and climate | 7 |
| 9. | The different assumed lines on earth, natural regions of the world, equatorial, warm-temperate, deciduous, coniferous, tundra, etc. | 6 |
| 10. | North America, location, physical features climate and natural vegetation | 7 |

| S.No | Concepts | No of questions selected |
|---|---|---|
| 11. | Economic resources, agriculture, power, minerals, important industries | 6 |
| 12. | Transport-roads, railways, water ways, airways, trade and commerce, population, countries of North America | 5 |
| 13. | Europe, location, physical features, climate Natural vegetation | 7 |
| 14. | Economic resources, population, agriculture, power minerals, important industries trade and commerce | 7 |
| 15. | India, location, natural divisions, rivers climate and vegetation, distribution of rain fall, irrigation | 7 |
| 16. | Economic resources, population, agriculture forests animals, power, minerals | 6 |
| 17. | Industries and trade, multipurpose projects, industries and transports | 7 |

3.2.7 Administration of the Test (Pilot Testing)

Two schools from Baroda and two schools from Madras were selected for the administration of the preliminary test. The details of the samples were discussed under daption 2.2.1.1. After obtaining permission from the respective authorities, the investigator administered the tests personally in Baroda High School, and Vidyakunj High School of Baroda, and Central School, Guindy, and Rani Meyyammai High School, Adayar of Madras. After consultations with some of the geography teachers, it was thought fit to give two hours time dura-

tion for the whole test. The students were given a week's time for their preparation. They were informed that this was a different type of test and they could prepare for the test from their course, but some of the questions might be from what they have learned in the lower classes also.

At the informed time, the investigator administered the test to the students. He read the instructions first and asked the students to follow them. The students found some difficulties to answer the questions at first. For each question they had to consult the examples. In certain cases for example question 3 and 4 some students found it difficult to grasp what they had to do for the questions. The investigator went on explaining them individually. He also observed the whole situation and noted the questions, points of doubts, and clarifications asked by the students in a sheep of paper, so that they can be rectified or modified in the final test. The students completed the test in one hour and fortyfive minutes.

### 3.2.8 Scoring of GATSI (Pilot Testing)

This test consists of items which will have either one right answer, or more than one right answer. Hence, the items were divided into two types, viz., (i) the Unianswer type and (ii) the Multianswer type. The unianswer type items were scored in the normal way, such as, one score for one right answer. Regarding the multianswer type, separate scoring system was followed. The following paragraphs briefly describe how the particular item was scored.

Table

As seen from 3.2 the questions for divergent production of semantic unit, divergent production of semantic relation, and divergent production of semantic system (question 13, 15 and 16) are testing ideational fluency, associational fluency and expressional fluency respectively. For fluency all the right answers were given one score for each response. The maximum fluency score for each of the above questions would be three, as the responses were restricted to three.

The various uses of 'maps' and 'globes', that is question 14 is testing spontaneous flexibility. Flexibility means the different kinds of approaches or varieties of answering the questions. For finding out the various answers a stratified sample of 50 test scripts representing the four schools were taken and the answers for the question were analysed by counting the frequencies for different uses for the 'maps' and 'globes' which are the test items. From this analysis, a broad classification of different uses of 'maps and globes' were prepared. It was also decided that if some other responses were found in scoring the remaining scripts, it will be considered as a new category of response. The following are the classifications made for scoring question 14a.

Various uses of the 'maps'

a. Location of areas

b. Useful for travel, navigation, etc.

c. Knowing about places

d. Finding out the distance between places.

e. Understanding the climatic conditions.

f. Finding out the latitudes and longitudes.

g. Knowing the shape of the countries.

h. To learn geography

i. To know the different timings of different countries.

j. For military purposes

Various uses of Globes. (question 14b)

a. Location of places.

b. To find latitude and longitude.

c. To know how days and nights are changing.

d. To understand the shape and size of the earth.

e. For travel and transportation.

f. To find the distance of places.

For actual scoring of this question, at first, each response was classified into different categories. Scores were given according to the categories. For example, if a student has given answers, that may be put under three categories then his flexibility score will be three; and another student's answers, if put under only one category, his score will be one only. The maximum score, one can get for this item is three.

Question 17 is testing the 'originality'. Scoring for this was done in a different way. Here unusual responses and the clever ideas are to be measured. Therefore, it was decided to examine the responses of direct consequences and

indirect consequences of the given problem situations. For this purpose, the various responses given by the students for the two items of this question were pooled together. The two items of this question were: (1) 'What would be the different consequences, if steel is not produced on earth?'. (17a), and 'What would be the different consequences, if Africa changes its position with Europe?' (17b). The pooled answers as said above were given to nine judges selected from the research fellows of the Centre of Advanced Study in Education, Baroda, and they were requested to point out direct and indirect consequences of the given problem situation. The opinion of the judges were consolidated and a key was prepared to score the answers for these questions.

TABLE 3.5 KEYS FOR SCORING ORIGINALITY (Question 17a)

| S.No | Responses | Direct (D) / Indirect (I) |
|---|---|---|
| 1. | Trains cannot run | I |
| 2. | Rails cannot be made | D |
| 3. | There can be no modern equipment | I |
| 4. | Developing countries will suffer | I |
| 5. | There will be no industries | I |
| 6. | There will be no trade and commerce | I |
| 7. | There will be no vehicles | D |
| 8. | Big buildings cannot be constructed | I |
| 9. | Utensils cannot be made | D |
| 10. | Locks cannot be made | D |

| S.No | Responses | Direct (D) / Indirect (I) |
|---|---|---|
| 11. | There will be no machinery | I |
| 12. | There will be unemployment | I |
| 13. | No travel | I |
| 14. | There will be no automobiles | I |
| 15. | It would have been old stonage | I |
| 16. | Bridges cannot be built | I |

TABLE 3.6 KEYS FOR SCORING ORIGINALITY (Question 17b)

| S.No | Responses | Direct (D) / Indirect (I) |
|---|---|---|
| 1. | Asia will be separated from Europe | D |
| 2. | Climate of both countries will change | D |
| 3. | Vegetation of both the countries change | I |
| 4. | People of both the countries change | I |
| 5. | Boundaries of both the countries change | D |
| 6. | Sahara will become fertile | I |
| 7. | Africa will become a developed country soon | I |
| 8. | The colour of the people of Europe may become black | I |
| 9. | Europe will be, not in temperate region | I |
| 10. | Negroes will experience severe cold | D |

In the scoring of this item, a credit of one score was given only for the indirect responses. The maximum scores a student can get for an item of this question is three, as the

maximum number of responses restricted was three.

Question 18 tests the ability of 'elaboration', which is the production of detailed ideas (DMI). For scoring this item, it was decided to have three points for each response, such as, 0, 1, and 2. If the response is irrelevant 0 score, if it is relevant but not descriptive or elaborate, one score, and if it is descriptive 2 scores were given. Thus the maximum score a student can get for each item of this question is 6.

Besides the above items under the operation of divergent production, the following six questions were also brought under multianswer type. Out of these questions for testing general reasoning (4), penetration (5), semantic redefinition (23), and attribute listing (24) of the GATSI were scored like the following. One point was given for a justified correct answer. The maximum socre that a student can get is three for each item.

For testing memory for semantic system (Question 10) order was important. If all the answers were given in order either from north to south or south to north for item 10a, and smaller to bigger or bigger to smaller for item 10b, then full score of three was given. If there is no order, even though responses were given, no score was given. If the order was not completely maintained, proportionate scores were given.

For testing 'the ability to see classes' (Question 20) if the answers were given in four distinct categories with all responses marked correct, full score of four was given. If the four categories were not made, no score was given. If the four categories were made and not all responses given, then proportionate scores were given.

### 3.2.9 Item Analysis

Item analysis is one of the essential steps in the development of psychological tests. Gulliksen (1950), Guilford (1954), Garrett (1961), and Ebel (1972) have fovoured employing item analysis in order to improve the reliability and validity of the test. Item analysis primarily concerns with item difficulty and item discrimination. Item difficulty is taken in terms of the proportion of individuals completing the item successfully and its discrimination index refers to the degree to which it differeniates between those obtaining high and low scores.

The present test is having both the unianswer type and multianswer type of questions. Hence it was decided to do the item analysis for this test into two different wasys. One type of analysis was employed for the unianswer type of questions and the other for the multianswer type of questions. In this regard, it is being made clear that besides the six questions under divergent production such as, for testing

ideational fluency (question 13), spontaneous flexibility (14), associational fluency (15), expressional fluency (16), originality (17), and elaboration (18), some of the other questions, such as, for testing general reasoning (4), penetration (5), learned information (10), ability to see classes (20), semantic redefinition (23), and attribute listing (24), also could not be analysed by the usual way of item analysis. Hence, the finding of the discrimination and difficulty of items was done by biserial correlation for the items testing the abilities, such as, verbal comprehension (1), verbal-classification (2), verbal analogies (3), concept foresight (6), memory for ideas (7), concept recall (8), finding the relation with the definition (9), memory for word meanings(11), memory for paired associates (12), location of central idea(19), eduction of conceptual correlates (21), ordering (22), class specification from the list of possible answers (25), class idea to be evaluated (26), logical evaluation (27), experimental evaluation (28), production of answers involving the interpretation of common objects (29), and sensitivity to problems (30). The remaining items were treated in another way which is explained under caption 3.2.11. The item analysis was based on the scores of 200 students.

3.2.10 Item Analysis for the Unianswer type

The following procedures were followed to carry on the item analysis for the unianswer type items.

(i) After scoring was finished the scripts were arranged in

order from the highest score to the lowest score.

(ii) 27 percent of the answer scripts (54 in number) were selected from the upper scores and similarly 27 percent (54 in number) were selected from the lower scores. The middle group was set aside separately.

(iii) The percentage of right answers for each question in the higher group and the percentage of right answers for each question in the lower group were found out.

(iv) The difficulty index of each item is found by averaging the percents correct in the upper and lower groups.

(v) The discriminative power (validity index) of each item was found by computing bi-serial correlation.Table 3.7 shows all the unianswer type items and their difficulty and the validity indices.

TABLE 3.7 UNIANSWER TYPE ITEMS AND THEIR DIFFICULTY AND VALIDITY INDICES

| Item No. | Code | Difficulty index | Validity index r-bis |
|---|---|---|---|
| 1a | CMU | .41 | .56 |
| b | " | .13 | .50 |
| c | " | .38 | .52 |
| d | " | .31 | .50 |
| 2a | CMC | .58 | .42 |
| b | " | .62 | .65 |
| c | " | .41 | .48 |
| d | " | .67 | .48 |

| Item No. | Code | Difficulty index | Validity index r-bis |
|---|---|---|---|
| 3a | CMR | .87 | .52 |
| b | " | .28 | .34 |
| c. | " | .67 | .50 |
| d | " | .56 | .25 |
| 6a | CMI | .54 | .44 |
| b | " | .16 | .55 |
| c | " | .45 | .78 |
| 7a | MMU | .93 | .38 |
| b | " | .61 | .48 |
| c | " | .82 | .62 |
| d | " | .36 | .39 |
| 8a | MMC | .69 | .55 |
| b | " | .82 | .63 |
| c | " | .77 | .52 |
| d | " | .54 | .33 |
| 9a | MMR | .54 | .11 |
| b | " | .24 | .24 |
| c | " | .53 | .54 |
| d | " | .41 | .08 |
| 11a | MMT | .67 | .71 |
| b | " | .91 | .45 |
| c | " | .87 | .53 |
| d | " | .86 | .55 |
| 12a | MMI | .54 | .59 |
| b | " | .89 | .30 |

| Item No. | Code | Difficulty index | Validity index r-bis |
|---|---|---|---|
| 12c | MMI | .62 | .06 |
| d | " | .88 | .48 |
| 19a | MMU | .38 | .51 |
| b | " | .30 | .28 |
| c | " | .73 | .37 |
| d | " | .45 | .31 |
| 21a | MMR | .16 | .55 |
| b | " | .32 | .51 |
| c | " | .93 | .33 |
| d | " | .11 | .45 |
| 22a | MMS | .53 | .47 |
| b | " | .41 | .31 |
| c | " | .57 | .51 |
| d | " | .65 | .65 |
| 25a | EMU | .53 | .58 |
| b | " | .46 | .29 |
| c | " | .48 | .49 |
| d | " | .45 | .39 |
| 26a | EMC | .46 | .16 |
| b | " | .55 | .31 |
| c | " | .24 | .35 |
| d | " | .30 | .25 |
| 27a | EMR | .36 | .48 |
| b | " | .21 | .20 |
| c | " | .29 | .36 |

| Item No. | Code | Difficulty index | Validity index r-bis |
|---|---|---|---|
| 27d | EMR | .36 | .31 |
| 28a | EMS | .32 | .51 |
| b | " | .51 | .50 |
| c | " | .16 | .55 |
| 29a | EMT | .40 | .13 |
| b | " | .31 | .20 |
| c | " | .56 | .16 |
| d | " | .66 | .27 |
| 30a | EMI | .22 | .34 |
| b | " | .28 | .34 |

For selecting the items from the above, both the difficulty and the validity indices were considered. A validity index of atleast .20 was kept as optimum for the inclusion of the item in the final test. (Garrett 1961). Simultaneously, the difficulty index was also considered for the selection of the item. Care was taken to avoid the too easy as well as too difficult test items. On the basis of the above criteria, the following items of the unianswer type questions were selected for the final test. Table 3.8 shows the items selected for the final test from unianswer type questions.

. TABLE 3.8 ITEMS SELECTED FOR FINAL TEST FROM UNIANSWER TYPE

| Item No. | Code | Item content |
|---|---|---|
| 1a | CMU | Plateau |
| c | " | Deciduous forests |
| 2c | CMC | Climate |
| d | " | Cereals |
| 3a | CMR | Paper industry |
| c | " | Switzerland |
| 6a | CMI | Coastal people |
| c | " | Source of power |
| 7b | MMU | Dark continent |
| d | " | Imaginary line |
| 8a | MMC | Mountains |
| d | " | Forests |
| 9b | MMR | Anticyclone |
| c | " | Barometer reading |
| 11a | MMT | Hurricane |
| b | " | Barometer |
| 12a | MMI | Earthquake |
| b | " | Monsoon |
| 19c | NMU | Mineral |
| d | " | Climatical regions |
| 21b | NMR | Leeward side |
| c | " | Longitude |
| 22b | NMS | Monsoon |
| d | " | Lumbering |

| Item No. | Code | Item content |
|---|---|---|
| 25a | EMU | Tide |
| d | " | People's characteristics |
| 26b | EMC | Chinook winds |
| c | " | Marine erosion |
| 27a | EMR | Profession |
| c | " | Longest river |
| 28a | EMS | Average temperature |
| b | " | Dairy industry |
| 29b | EMT | Rain fall |
| d | " | Tea plantation |
| 30a | EMI | Fruit production |
| b | " | Wheat production |

3.2.11 Item Analysis: Multianswer type

Just as for the unianswer type of items as mentioned above, two different types of analysis were done for each multianswer type question. The first type involved the calculations of Mean, SD and their level of significance with a view to ensure that such items could adequately elicit responses and demonstrate individual differences The second type of analysis concerned the dalculation of item discrimination, in terms of t-ratio by taking upper and lower 27 percent cases of the sample. Table 3.9 shows the multianswer type items and their Mean, SD and significance.

TABLE 3.9 MULTIANSWER TYPE ITEMS AND THEIR MEAN, SD, AND MINIMUM VALUE OF MEAN FOR SIGNIFICANCE AT 0.01 LEVEL

| Item No. | Code | Mean | SD | Mimimum value of mean |
|---|---|---|---|---|
| 13a | DMU | .91 | 1.07 | .20 |
| b | " | 1.46 | 1.11 | .21 |
| 14a | DMC | 2.02 | .83 | .16 |
| b | " | 1.23 | 1.03 | .19 |
| 15a | DMR | .52 | .89 | .17 |
| b | " | .77 | 1.13 | .21 |
| 16a | DMS | .58 | 0.97 | .18 |
| b | " | .47 | 0.89 | .17 |
| 17a | DMT | 1.15 | 0.94 | .18 |
| b | " | .73 | 0.96 | .18 |
| 18a | DMI | 1.70 | 1.40 | .26 |
| b | " | .77 | 1.24 | .23 |
| 4a | CMS | 1.23 | 1.13 | .21 |
| b | " | .82 | .98 | .18 |
| c | " | .93 | 1.10 | .21 |
| d | " | .61 | .90 | .17 |
| 5a | CMT | .62 | .93 | .17 |
| b | " | .90 | .98 | .18 |
| c | " | .74 | 1.02 | .19 |
| d | " | 1.12 | .80 | .15 |
| 10a | MMS | .31 | .74 | .14 |
| b | " | 1.79 | .94 | .18 |
| c | " | 1.18 | 1.22 | .23 |
| d | " | .52 | .78 | .15 |
| 20a | NMC | 1.99 | 1.45 | .27 |

| Item No. | Code | Mean | SD | Minimum value of mean |
|---|---|---|---|---|
| 20b | NMC | 1.94 | 1.33 | .25 |
| 23a | NMT | .56 | .87 | .16 |
| b | " | .74 | 1.02 | .19 |
| c | " | .33 | 0.64 | .12 |
| 24a | NMI | 1.04 | 1.12 | .21 |
| b | " | .88 | 1.03 | .19 |
| c | " | .60 | .84 | .16 |
| d | " | .69 | 1.02 | .21 |

From Table 3.9, it is seen that all the items are having significant mean that shows they elicit answers. The t-ratio between the higher and lower groups' mean scores indicate the discrimination of items. Table 3.10 shows the t-ratio for the above multianswer type items.

TABLE 3.10 THE t-RATIO BETWEEN THE UPPER 27 PERCENT AND THE LOWER 27 PERCENT FOR MULTIANSWER TYPE ITEMS

| Item No. | Code | t-ratio between upper and lower 27 percent cases |
|---|---|---|
| 13a | DMU | 6.14 |
| b | " | 8.10 |
| 14a | DMC | 8.80 |
| b | " | 7.53 |
| 15a | DMR | 6.74 |
| b | " | 9.06 |

| Item No | Code | t-ratio between upper and lower 27 percent cases |
|---|---|---|
| 16a | DMS | 8.87 |
| b | " | 0.70 |
| 17a | DMT | 4.50 |
| b | " | 8.03 |
| 18a | DMI | 6.98 |
| b | " | 7.87 |
| 4a | CMS | 5.65 |
| b | " | 7.34 |
| c | " | 7.88 |
| d | " | 2.30 |
| 5a | CMT | 6.33 |
| b | " | 5.10 |
| c | " | 10.13 |
| d | " | 8.35 |
| 10a | MMS | 5.22 |
| b | " | 2.10 |
| c | " | 7.00 |
| d | " | 5.00 |
| 20a | NMC | 8.25 |
| b | " | 13.60 |
| 23a | NMT | 3.50 |
| b | " | 3.28 |
| c | " | 5.00 |
| 24a | NMI | 6.51 |
| b | " | 11.50 |
| c | " | 8.51 |
| d | " | 4.55 |

Considering the t-value, exdept for items 16b and 4d, all other items are significant at point 0.01 level. Item 4d is significant at point 0.05 level. Item 16b is not significant. Item 4d was rejected. For 16b, the item was replaced by a new item for there were only two items in the preliminary test. Instead of the original item, 'The Great Barrier reef is ----------', the new item of 'The Panama cannal is ---------' was introduced. All the other items under divergent production were kept for the final test as they satisfy the statistical conditions. For the questions 4, 5, 10,20, 23 and 24, the same standards as mentioned above were followed in their selection. Since, two items have to be selected from them, the best two items satisfying both the significance of mean and critical ratio were selected. Table 3.11 shows the final items selected from the multianswer type questions. Thus the final test had 30 questions representing all the Semantic products of SI model. Each questions had two parts like (a) and (b)

TABLE 3.11 ITEMS SELECTED FOR FINAL TEST FROM MULTIANSWER TYPE

| Item No. | Code | Item content |
|---|---|---|
| 13a | DMU | Depth of the oceans |
| b | " | Great Himalayas |
| 14a | DMC | Maps |
| b | " | Globes |
| 15a | DMR | Igneous rocks |
| b | " | Temperate grass lands |

| Item No | Code | Item content |
|---|---|---|
| 16a | DMS | Precipitation |
| b | " | Panama cannal |
| 17a | DMT | Steel production |
| b | " | Position of Africa and Europe |
| 18a | DMI | Petroleum |
| b | " | Cocoa cultivation |
| 4a | CMS | Summer of equatorial region |
| c | " | Trade |
| 5b | CMT | Waves |
| c | " | Glacier |
| 10a | MMS | Natural vegetation of N. America |
| c | " | Continents |
| 20a | NMC | Rivers, instruments, etc. |
| b | " | Cities, plantation crops, etc. |
| 23a | NMT | Eskimoes |
| b | " | Monsoon |
| 24a | NMI | Cultivation of wheat |
| b | " | Setting up ship building unit |

Besides the item selection, some other refinements also were made in the final test, on the basis of the experiences gained by the investigator while administering and scoring the test. One of the instructions, viz., No. 9 was removed as it was confusing the students. The example given there was taken to the appropriate place in question number 27. A new instruction 'You have to imagine geographically

for answering certain questions' was introduced in order to help the students as to what to do regarding certain of the multianswer type questions. Some of the wordings of certain questions and examples wherever the students found difficult to comprehend during try-out study were suitably altered in the final form. Table 3.12 shows the concepts, number of items, and the name of SI factors selected for the final test.

TABLE 3.12 CONCEPTS, NUMBER OF ITEMS AND SI FACTORS SELECTED FOR THE FINAL TEST

| S.No | Concepts | No. of items | SI factor testing |
|---|---|---|---|
| 1. | Fall of sun's rays, measurement of temperature, factors affecting temperature, Isotherms, Isothermal maps | 2 | CMS, EMS |
| 2. | Humidity and condensation, rainfall, relief, convection, rain shadow, measurement of rain | 3 | DMS, NMR, EMT |
| 3. | Structure of earth, lithosphere hydrosphere, barrisphere, and atmosphere | 3 | CMU, EMU, DMC |
| 4. | Air pressure, pressure belts of world, barometer, winds, permanent windsystem of the world, trade and antitrade winds | 3 | MMR, MMT, MMT |
| 5. | Periodical winds, Monsson, Fohn Chinook, Typhoon, Tornodoes, cyclones and anticyclones | 4 | DMC, MMI, NMT, EMC |
| 6. | Rocks, volcanoes, distribution of volcanoes, earthquakes | 2 | MMI, MMR |
| 7. | Ocean movements, waves, currents, warm and cold, effects of ocean currents on climate and nagication tides, spring and neap tides | 3 | CMS, CMT, DMU |

| S.No | Concepts | No. of items | SI factor testing |
|---|---|---|---|
| 8. | Earth sculpture denudation-transportation and deposition, action of rain, sun, frost, atmosphere, rivers, glaciers, winds, underground and sea water climate determining factors, weather and climate | 3 | DMR, EMC, MMU |
| 9. | The different assumed lines on earth, natural regions of the world, equatorial, warm temperate, deciduous, coniferous, tundra, etc. | 6 | CMC, MMU, MMC NMR, NMT, NMU |
| 10. | North America, location, physical features climate and natural vegetation | 4 | CMU, MMS, DMR, DMS |
| 11. | Economic resources, agriculture, power, minerals, important industries | 6 | CMI, MMC, MMS, NMS, NMI, EMS |
| 12. | Transport, roads, railways, waterways, airways, trade and commerce, population, countries of North Amerioa | 3 | NMC, CMT, CMR |
| 13. | Europe, location, physical features, climate, natural vegetation | 5 | CMR, DMT, EMR EMI, EMI |
| 14. | Economic resources, population, agriculture, power, minerals, important industries trade and commerce | 5 | MMC, NMI, EMU EMT, NMU |
| 15. | India, location, natural divisions, rivers climate and vegetation, distribution of rain fall irrigation | 4 | CMC, DMU, NMS EMR |
| 16. | Economic resources, population, agriculture, forests, animals, power, minerals | 2 | DMT, DMI |
| 17. | Industries and trade, multipurpose projects, industries and transports | 2 | CMI, DMI |

### 3.2.12 Establishing Reliability and Validity

The reliability and the validity of the test determine its utility and efficiency. It was therefore thought appropriate to establish reliability and validity of the GATSI. The reliability and validity studies were conducted on a sample of sixty subjects. The selection of the sample was discussed under caption 2.2.1.2 and shown in Table 2.5.

### 3.2.13 Reliability

The sample size of sixty students was considered appropriate for the purpose of conducting reliability and validity studies in view of the difficult process of administration and time consuming scoring procedures.

After the selection of final items on the basis of item analyis, the test was administered again to eighth grade students of the same two schools, one in the city of Baroda and the other in Madras. Since all the thirty questions of the test were having two items in each, the split half method of establishing reliability was employed. The total scores for the odd number items and even number items of the questions for each student were taken and the product-moment correlation was computed. When the Spearman-Brown formula was applied the co-efficient of correlation was 0.92.

3.2.14 Validity

Validity study was conducted on the sample of sixty subjects. (vide Table 2.5). The external criteria of Achievement scores in geography in their eighth grade annual examinations for the same subjects were obtained. Product-moment coefficient of correlation was employed between the annual examination marks of the students in geography, and their GATSI scores. The concurrent validity comes to 0.57.

Reviewing the results given in research literature and relating them to the results of the present study, it is safe and encouraging to say that the present validity results are in line with them. The test of GATSI, thus can be claimed a valid tool for this investigation.

### 3.3.0 Achievement Tests in Geography

There was no standardised test available that could be used as one of the criterion tests to measure the achievement in geography of the students in the present experiment. Three achievement tests were hence developed by the investigator. Those were: (i) Achievement Test I in Geography(ACHA), (ii) Achievement Test II in Geography (ACHB), and (iii) Achievement Test III in Geography (ACHC). The development of the tests have been discussed under two sub-headings: (i) Preliminary drafts, and (ii) final drafts.

### 3.3.1 Preliminary Drafts

The preliminary drafts of the three achievement tests consisted of items on knowledge, comprehension and application from the respective courses covered during the experimental period. Table 3.13 presents a blue-print of the items in the preliminary drafts of the three tests.

TABLE 3.13 COURSES COVERED AND THE NUMBER OF ITEMS SELECTED UNDER ACHIEVEMENT TESTS (ACHA, ACHB, ACHC)(Preliminary Tests)

| Name of the test | Code | Courses covered | No. of items | Knowledge | Comprehension | Application |
|---|---|---|---|---|---|---|
| Achievement Test I in Geography | ACHA | Americas: Historical survey of N.America, relief, structure and drainage, climate | 31 | 12 | 16 | 3 |
| Achievement Test II in Geography | ACHB | North America, climate natural resources, agriculture. | 36 | 10 | 21 | 5 |
| Achievement Test III in Geography | ACHC | North America, industries, transport, population and trade | 30 | 10 | 13 | 7 |

The preliminary drafts of the Achievement Test I in Geography, Achievement Test II in Geography, and Achievement Test III in Geography, were originally prepared in Tamil language and administered to the two sections of the Tamil medium students of eighth grade drawn one each from the Voohrees High School and the Krishna Swamy Mudaliar High School of the Vellore town. Details about the selection of sample have been given in chapter II. Because the syllabi and the courses to be covered within the particular duration shall be similar with the other classes of the same school, it was thought fit to have the sample for the administration of the preliminary drafts taken from the same schools, where the experiment was conducted, but with Tamil medium students.

With a general understanding of the nature of pupils of eighth grade, and on the experience of having taught the students of the experimental group and on consultation with the regular geography teachers of the schools, a time duration of 40 minutes was allowed for each of the tests. This was found to be sufficient. The items were subjected to item analysis using the Flanagan's Biserial correlation Table (Davis 1963, Garrett 1966). Validity and difficulty indices of the items in each of the tests were calculated.

### 3.3.2 Final Drafts

In a teacher made test, items with discriminatory indices between 0.20 and 0.40 are of some value, in discriminating between examinees. Items with indices between 0.40 and 0.60 are good discriminators. Those with indices above 0.60 are unusually good (Marshall and Hales, 1971). Keeping this in consideration, items which had a validity index of 0.22 (same as discrimination index) were included in the final draft. Table 3.14 provides the validity and difficulty indices of the items, selected for the final drafts of the three criterion tests.

TABLE 3.14 VALIDITY AND DIFFICULTY INDICES OF THE ITEMS SELECTED FOR ACHIEVEMENT TESTS (ACHA, ACHB, ACHC)

| Item No. | Achievement Test I in Geography | | Achievement Test II in Geography | | Achievement Test III in Geography | |
|---|---|---|---|---|---|---|
| | Validity index | Difficulty index | Validity index | Difficulty index | Validity index | Difficulty index |
| 1 | .21 | .31 | .28 | .30 | .31 | .25 |
| 2 | .25 | .46 | .31 | .36 | .24 | .31 |
| 3 | .30 | .36 | .26 | .28 | .37 | .56 |
| 4 | .22 | .65 | .24 | .37 | .29 | .50 |
| 5 | .23 | .22 | .34 | .37 | .40 | .55 |
| 6 | .22 | .37 | .29 | .45 | .37 | .48 |
| 7 | .25 | .49 | .30 | .62 | .32 | .37 |
| 8 | .26 | .62 | .33 | .50 | .36 | .66 |
| 9 | .31 | .45 | .29 | .55 | .45 | .44 |
| 10 | .23 | .38 | .22 | .40 | .22 | .22 |
| 11 | .42 | .19 | .37 | .17 | .31 | .37 |
| 12 | .26 | .28 | .42 | .34 | .22 | .40 |
| 13 | .28 | .18 | .28 | .34 | .28 | .34 |
| 14 | .34 | .48 | .25 | .55 | .27 | .64 |
| 15 | .21 | .60 | .33 | .54 | .26 | .18 |
| 16 | .37 | .24 | .26 | .19 | .44 | .52 |
| 17 | .21 | .43 | .27 | .29 | .21 | .40 |
| 18 | .25 | .61 | .25 | .49 | .21 | .57 |
| 19 | .38 | .49 | .42 | .59 | .23 | .58 |
| 20. | .34 | .33 | .21 | .44 | .30 | .44 |

| Item No. | Ahievement Test I in Geography | | Achievement Test II in Geography | | Achievement Test III in Geography | |
|---|---|---|---|---|---|---|
| | Validity index | Difficulty index | Validity index | Difficulty index | Validity index | Difficulty index |
| 21 | .38 | .50 | .21 | .48 | .27 | .34 |
| 22 | .37 | .52 | .21 | .35 | .25 | .45 |
| 23 | .21 | .40 | .24 | .45 | .35 | .65 |
| 24 | .32 | .43 | .22 | .34 | .44 | .64 |
| 25 | .24 | .37 | .21 | .40 | .26 | .34 |
| 26 | .32 | .26 | .29 | .58 | | |
| 27 | .41 | .18 | .33 | .60 | | |
| 28 | .21 | .35 | .31 | .26 | | |
| 29 | | | .25 | .29 | | |
| 30 | | | .21 | .36 | | |

The final draft of the Achievement Test I in Geography, Achievement Test II in Geography, and Achievement Test III in Geography contained 28, 30, and 25 items respectively. Table 3.15 presents the total number of items under knowledge, comprehension and application included in the final drafts.

TABLE 3.15 ITEMS SELECTED FOR THE FINAL TESTS(ACHA, ACHB, ACHC)

| Name of the test | Code | Courses covered | No. of items | Knowledge | comprehension | Application |
|---|---|---|---|---|---|---|
| Achievement Test I in Geography | ACHA | Americas: Historical survey of N. America, relief, structure, drainage and climate | 28 | 10 | 16 | 2 |
| Achievement Test II in Geography | ACHB | North America, climate, natural resources, agriculture | 30 | 7 | 20 | 3 |
| Achievement Test III in Geography | ACHC | North America, industries, transport population and trade | 25 | 9 | 11 | 5 |

3.3.3 Reliability and Validity of the Achievement Tests

The test-retest method was employed to find out the reliability of the three achievement tests. The sample selected for this purpose was two sections of eighth grade students, one each from the Voohrees High School, Vellore and the other Krishna Swamy Mudaliar High School, Vellore. Retesting was administered two weeks after the first test. The coefficient of the correlation for the test-retest reliability found for the Achievement Test I in Geography, Achievement Test II in Geography and Achievement Test III in Geography have been 0.78, 0.77 and 0.65 respectively.

Validity of the three achievement tests was established

by computing the product moment correlation with the external criteria of the geography scores of the quarterly examination for the same students. The coefficient of the correlation for the concurrent validity for Achievement Test I in Geography, Achievement Test II in Geography and Achievement Test III in Geography have been 0.51, 0.67, and 0.49 respectively. The time limit for each of the tests was fixed to be 30 minutes. The preliminary and final drafts of the tests are given in the appendix.