CHAPTER – III

RESEARCH DESIGN

3.1 : Population
3.2 : Sample
3.3 : Tools Used
3.4 : Method of the Study
3.5 : Collection of Data
3.6 : Statistical Techniques Used
CHAPTER – III

RESEARCH DESIGN

Research Design is the conceptual structure within which the research is conducted. As such it includes an outline of what the researcher will do after formatting the research. It also constitutes the blue print for the population, sample, tools, and method of study and procedures of data collection. It describes the detail of statistical techniques used. It is needed because it facilitated the smooth sailing of the various research operations.

3.1 POPULATION:

The word population is commonly used to denote a group or an aggregate of people. It refers to any well defined group or aggregate of people, animals, objects etc of a particular type. For the present study, the population comprises of both Khasi boys and girls students of the state of Meghalaya studying in classes VIII to X of the age group 14 to 16 + years. The total number of Khasi speaking students studying in classes VIII, IX and X were approximately as follows as per the information collected from the Districts Inspector of schools (year 2005):
Table 3.1: Distribution of the Khasi Speaking Students in Class VIII-X

<table>
<thead>
<tr>
<th>District</th>
<th>VIII</th>
<th>IX</th>
<th>X</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>East Khasi Hills</td>
<td>7619</td>
<td>6810</td>
<td>5033</td>
<td>19462</td>
</tr>
<tr>
<td>West Khasi Hills</td>
<td>1896</td>
<td>1600</td>
<td>1455</td>
<td>4951</td>
</tr>
<tr>
<td>Jaintia Hills</td>
<td>2359</td>
<td>2196</td>
<td>1801</td>
<td>6356</td>
</tr>
<tr>
<td>Ri-Bhoi</td>
<td>509</td>
<td>460</td>
<td>372</td>
<td>1341</td>
</tr>
<tr>
<td>Total</td>
<td>12383</td>
<td>11066</td>
<td>8661</td>
<td>32110</td>
</tr>
</tbody>
</table>

3.2 SAMPLE:

A sample is a fraction of population drawn by using a suitable method so that it can be regarded as representative of the entire population. For the present study, the investigator has adopted the Simple Random Method which was found appropriate for the study. Simple Random Sampling may be defined as one in which each and every individual of the population has an equal chance of being included in the sample and the selection of one individual is in no way dependent upon the selection of another person.

The present study had three sets of samples for the different stages of test construction which were as follows.

(a) Sample for Preliminary Try-out:

For the preliminary try-out a very small sample of 180 Khasi students studying in classes VIII - X was taken randomly comprising of 80 boys and 100 girls.

(b) Sample for First Try-out:

For the first try-out of the test a sample of 555 Khasi students comprising of 277 boys and 278 girls was selected randomly representing each grade as follows.
Table 3.2: Sample for First Try-out

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>School</th>
<th>Class</th>
<th>B</th>
<th>G</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DNS. Wahlang M.H. S</td>
<td>VIII</td>
<td>28</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>2</td>
<td>Got. Boys H.S.</td>
<td>VIII</td>
<td>62</td>
<td>-</td>
<td>62</td>
</tr>
<tr>
<td>3</td>
<td>St. Joseph’s Girls H.S</td>
<td>VIII</td>
<td>-</td>
<td>68</td>
<td>68</td>
</tr>
<tr>
<td>4</td>
<td>Christ Church H.S.</td>
<td>IX</td>
<td>26</td>
<td>32</td>
<td>58</td>
</tr>
<tr>
<td>5</td>
<td>Seng Khasi H.S.</td>
<td>IX</td>
<td>24</td>
<td>30</td>
<td>54</td>
</tr>
<tr>
<td>6</td>
<td>Sacred Heart Boys H.S.</td>
<td>IX</td>
<td>36</td>
<td>-</td>
<td>36</td>
</tr>
<tr>
<td>7</td>
<td>Brooke Side A. H.S.</td>
<td>IX</td>
<td>18</td>
<td>20</td>
<td>38</td>
</tr>
<tr>
<td>8</td>
<td>Laitumkhrah P.H.S.</td>
<td>X</td>
<td>24</td>
<td>25</td>
<td>49</td>
</tr>
<tr>
<td>9</td>
<td>Mawlai P.H.S.</td>
<td>X</td>
<td>35</td>
<td>43</td>
<td>78</td>
</tr>
<tr>
<td>10</td>
<td>Presbyterian T.S.S.</td>
<td>X</td>
<td>24</td>
<td>30</td>
<td>54</td>
</tr>
</tbody>
</table>

Total: 277 278 555

(c) Sample for the Final Try-out:

For the final try-out, a sample of 3000 Khasi students (approximately ten percent of the total population) comprising of 1298 boys and 1702 girls were selected randomly from the Khasi speaking population of 4 districts which were as follows:

Table 3.3: District-wise Break-up of Sample taken for Final Try-out

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>District</th>
<th>No. of schools</th>
<th>Sex</th>
<th>Class</th>
<th>Class</th>
<th>Class</th>
<th>Total</th>
<th>Grand Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>East Khasi Hills</td>
<td>19</td>
<td>B</td>
<td>143</td>
<td>204</td>
<td>158</td>
<td>505</td>
<td>1141</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>G</td>
<td>236</td>
<td>124</td>
<td>276</td>
<td>636</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>West Khasi Hills</td>
<td>10</td>
<td>B</td>
<td>107</td>
<td>186</td>
<td>87</td>
<td>380</td>
<td>920</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>G</td>
<td>180</td>
<td>240</td>
<td>120</td>
<td>540</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Jaintia Hills</td>
<td>10</td>
<td>B</td>
<td>72</td>
<td>93</td>
<td>107</td>
<td>272</td>
<td>613</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>G</td>
<td>156</td>
<td>51</td>
<td>134</td>
<td>341</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Ri- Bhoi</td>
<td>3</td>
<td>B</td>
<td>44</td>
<td>47</td>
<td>50</td>
<td>141</td>
<td>326</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>G</td>
<td>60</td>
<td>58</td>
<td>67</td>
<td>185</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>42</td>
<td></td>
<td>998</td>
<td>1003</td>
<td>999</td>
<td>3000</td>
<td>3000</td>
</tr>
</tbody>
</table>
3.3 TOOLS USED:

For the present study, the investigator used the following tools:

i. Verbal Group Test of Intelligence constructed and standardized by the investigator,

ii. Ahuja’s Group Test of Intelligence

iii. Cattell’s Culture Fair Test of Intelligence

iv. Rating scale constructed by the investigator

(i) Verbal Group Test of Intelligence constructed by the investigator (Appendices 1 & 2):

The investigator constructed and standardized a verbal group test of intelligence in the Khasi language to assess the intelligence of school going children of the state of Meghalaya studying in classes VIII, IX and X of the age group 14 to 16 + as has been described in chapter four. In short, the test contained the following ten sub-tests:

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Sub-tests</th>
<th>No. of Items</th>
<th>Time limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Classification</td>
<td>9</td>
<td>1(\frac{1}{2})</td>
</tr>
<tr>
<td>2</td>
<td>Coding</td>
<td>11</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>General Comprehension</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>Akin/Imitative Words</td>
<td>12</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>Verbal Analogy</td>
<td>10</td>
<td>2(\frac{1}{2})</td>
</tr>
<tr>
<td>6</td>
<td>General Reasoning</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>Number Series</td>
<td>13</td>
<td>4</td>
</tr>
<tr>
<td>8</td>
<td>Evaluation of Relationship</td>
<td>11</td>
<td>4</td>
</tr>
<tr>
<td>9</td>
<td>General Information</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>Arithmetic Reasoning</td>
<td>9</td>
<td>4</td>
</tr>
</tbody>
</table>

Total =100 30 mins
The reliability and validity of the test has been calculated by different methods which have been given in Chapter V. The norms of the test have also been prepared for both boys and girls and for different grades which have been described in chapter V.

(ii) Ahuja's Group Test of Intelligence\(^1\) (Appendix-3):

This test is meant for assessing the general mental ability of pupils in the age group 13 to 17 + years studying in classes VIII – XI through English Medium Secondary Schools of Greater Bombay. The Test consists of the following seven subtests with 126 items:

Table 3.5: Number of Items and Time-Limits for each Sub-test

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Sub-tests</th>
<th>Number of Items</th>
<th>Time-Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Classification</td>
<td>20</td>
<td>4 minutes</td>
</tr>
<tr>
<td>2</td>
<td>Analogy</td>
<td>20</td>
<td>4 minutes</td>
</tr>
<tr>
<td>3</td>
<td>Arithmetic Reasoning</td>
<td>6</td>
<td>4 minutes</td>
</tr>
<tr>
<td>4</td>
<td>Vocabulary</td>
<td>40</td>
<td>4 minutes</td>
</tr>
<tr>
<td>5</td>
<td>Comprehension</td>
<td>8</td>
<td>4 minutes</td>
</tr>
<tr>
<td>6</td>
<td>Series</td>
<td>12</td>
<td>4 minutes</td>
</tr>
<tr>
<td>7</td>
<td>Best Answers</td>
<td>20</td>
<td>4 minutes</td>
</tr>
<tr>
<td></td>
<td>No. of Items =126</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The test also contains one additional subtest which is meant for practice only. The item difficulty was determined by taking into account the proportion of the group which could solve an item correctly. The sample of 370 testees was divided into two groups of 100 each on the basis of upper and lower 27 percentiles. The reliability of the test has been studied by two methods- (i) the test –re-test method and (ii).the split-half method. The

\(^1\) C.G. Ahuja: "Construction and standardization of General Group Test of Intelligence (GGTI) in English for 13 to 17 years", Ph.D. Dissertation, 1966.
reliability coefficient by two methods was found to be 0.84 and 0.95 respectively. The validity of the test was studied with reference to school marks, teacher's judgment and other intelligence tests. The validity -coefficient with school marks was 0.53, with teacher's judgment was 0.61 and with other test of intelligence varied from 0.55 to 0.80. The internal validity and factorial validity of the test was also studied. The internal consistency correlation between the subtest and the total test scores were computed. The factorial validity was studied by Thurstone's centroid method and verified by Spearman's formula of 'g' saturation. It came out to be uni factor test.

Age norms and grade norms were worked out. Table of age-wise and grade-wise distribution of the test scores of both boys and girls were also worked out. The provision for further interpretations based on the deviation of a score from the corresponding class norm in the form of Percentile Ranks, Sigma Scores and Standard Scores have also been made. Side by side the Table of T- Score for age-wise and class-wise distributions for both boys and girls were also worked out. The Deviation IQs for the entire sample was established. Similarly tables of DIQ in age-wise and grade-wise for the entire sample were also ascertained.

(iii) Cattell's Culture Fair Test² (Appendix – 4):

This test is meant for measuring individual intelligence in a manner designed to reduce, as much as possible, the influence of verbal fluency, cultural climate and educational level. The test which may be administered individually or in group, are non-

verbal and require only that the examinees be able to perceive relationship in shapes and figures. The test is devised in a format of scale 1, 2 & 3 which was designed in form A & B. The scale 1 is meant for children and scale 2 & 3 for adults.

In the present study scale 2 in form A was used which contained four sub-tests as mentioned below:

**Items and Time Allotted to each Sub-test in the Scale 2 & 3**

<table>
<thead>
<tr>
<th>SCALE 2 (FORM A &amp; B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test</td>
</tr>
<tr>
<td>Test 1</td>
</tr>
<tr>
<td>Test 2</td>
</tr>
<tr>
<td>Test 3</td>
</tr>
<tr>
<td>Test 4</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

The reliability of the test in full form (A & B) and in short form (A) for scale 2 was estimated by applying three methods, viz., consistency over items, consistency over parts and consistency over times on different samples. The reliability coefficient of correlation of scale 2 in full (A & B) were found to be 0.87, 0.80 and 0.84 and 1 short form (A) were 0.76, 0.67 and 0.73 respectively. The reliability coefficient of correlation of scale 3 in full form (A & B) was found to be 0.85, 0.82 and 0.82 and in short form (A) was 0.74, 0.70 and 0.69 respectively.

The validity of the test was studied by the methods of concept validity and concrete validity. The validity coefficient of correlation of scale 2 in full form (A & B) was found to be 0.85 and 0.77 and in short form (A) was 0.81 and 0.70 respectively. The validity coefficients of correlation of scale 3 in full form (A & B) were found to be 0.92 and 0.69 and 1 short form (A) were 0.85 and 0.66 respectively.
Table of norms such as standardized IQ and Percentile Ranks were established for scale 2 & 3 in form A only.

(iv) Rating Scale for Estimating the Content Validity of the Test under Construction (Appendix -5):

The investigator constructed a rating scale to estimate the content validity of the intelligence test under construction. It contained seven items as given below:

1. How far the items listed in the test are representative of intellectual abilities of children?
   1  2          3          4
   To a great extent To quite an extent To some extent Not at all

2. Do you think that items listed in the test under reference would be able to measure the level of Intelligence of children?
   1  2          3          4
   To a great extent To quite an extent To some extent Not at all

3. To what extent have the test items covered the various components of intellectual abilities of children under different sub-tests?
   1  2          3          4
   To a great extent To quite an extent To some extent Not at all

4. Are the items suitable for school going children of the age group 14-16+ (Cl.VIII-X) in terms of the content presented?
   1  2          3          4
   To a great extent To quite an extent To some extent Not at all

5. Are the items suitable for school-going children of the age group 14-16+ (Cl.VIII-X in terms of items difficulties?
   2  3          4
   To a great extent To quite an extent To some extent Not at all
6. Are the items suitable for school-going children of the age group 14-16+ (Cl. VIII-X) in terms of the language used?

   1 2 3 4

   To a great extent  To quite an extent  To some extent  Not at all

7. To what extent are the test items related to the Khasi community?

   1 2 3 4

   To a great extent  To quite an extent  To some extent  Not at all

3.4 METHOD OF THE STUDY:

   A well-described method provides the investigator a scientific and feasible plan for solving the problem under investigation. The selection of a method of study depends on the nature and objectives of the study. As the objective of the present study is to construct and standardize an Intelligence test, the investigator decided to use a descriptive method of research, to prepare the following materials:

   A. Test Booklet –

   It is a small Book which contains the final form of the test. It includes the general instructions of the whole test, the specific directions and examples of each sub-test. A test booklet is often reusable.

   For the present study, the investigator has prepared a booklet, containing the general instructions of the test and ten sub-tests spreading in 100 items. In each subtest, necessary instructions and practice examples were provided. The investigator has carefully categorized the selection of items, so, as to make the present test comprehensive enough, to cover out the intellectual behaviour of the students of classes VIII –X., as follows:
1. Classification
2. Coding
3. General Comprehension
4. Akin/Imitative Words
5. Verbal Analogy
6. General Reasoning
7. Number Series
8. Evaluation of Relationship
9. General Information
10. Arithmetic Reasoning.

A. Test Manual:

Test manual is a book which gives a detailed description of the test. It guides the users about the test. The manual consists of the psychometric properties of the test, norms and references. It gives a clear indication regarding the procedures of the test administration, the scoring methods and time limits, if any, of the test. It also provides instructions as well as the details of arrangement of materials, that is, whether items have been arranged in random order or in any other order.

For the present study, the investigator has prepared a Manual of the test, which consists of the details of the following: (Appendix 1-B and 2-B):

(1). Construction procedure
(2). Direction for Administering and Scoring the test.
(3). Sample for Standardization
(4). Reliability and validity of the Test.
(5). Different kinds of Norms in Tables
(6). Interpretation.

B. Answer Sheet

For the present Test, a compiled answer sheet of all the subtests was prepared where in the subject (student) is required to put a X cross mark at the correct answer indicated by the alphabets A, B, C, D, (Appendix 1- C and 2 –C).

C. Scoring Key

For the scoring key of the present test, the investigator has prepared a transparent stencils , where the correct answer of each item of all the ten subtest were indicated by a box in a tracing paper (Appendix1-D and 2-D).

3.5 COLLECTION OF DATA:

Based on the nature of the study, the collection of data was done in three phases:

(a) First Phase:

The first phase of collection of data for the preliminary try-out was done in the month of May 2007. The test was administered to 180 Khasi students from 6 High Schools. Data obtained from this phase was used to make a preliminary modification of the test.
(b) Second Phase:

The second phase of data collection was done in October 2007. The same procedures of administering the test were followed by the investigator in the second phase. For this try-out a sample of 555 Khasi students were taken randomly from 10 High Schools (Table 3.2).

(c) Third Phase:

The third phase of data collection for final try-out was done in the months of May to August, 2008. In this phase a large sample of 3000 Khasi students were drawn from 42 High Schools (Table 3.3) of the schools population from four districts of Meghalaya. The data was collected by administering the following three tools:

(i). Investigator’s Group Test of Intelligence (in Khasi language).
(ii). Ahuja’s Group Test of Intelligence.
(iii). Cattell’s Culture Fair Test of Intelligence. (Scale 2 Form A)

To make the collection of data easier and faster, the investigator, approached the Director of Higher & Technical Education, Shillong, requested him to provide instructions to the Heads of selected schools, through the Districts Inspectors, to allow the investigator to conduct the tests smoothly. This had really helped the investigator to communicate with the Heads of schools, who had conveniently allowed the investigator to administer all the three mentioned tools to all the 3000 students. Data collected from the third phase was used for the standardization of the test.
3.6 STATISTICAL TECHNIQUES USED:

In the present study, the investigator used the following statistical techniques

(i) For scoring procedures: to avoid the problems of guessing, the formula of correcting the difficulty index of an item for chance success was used as suggested by Garrett.

\[ P_c = \frac{R - W/(K-1)}{N - HR} \]

(ii) For Item Analysis: the difficulty value and discriminative power of an item was calculated by applying Davis’s formula.

\[ DV = \frac{(P_u + P_l)}{2} \]

\[ DP = P_u - P_l \]

(iii) For Item selections: only the items whose difficulty values (DV) found between 0.30 to 0.70 and discriminative power (DP) equal to 0.40 and above as suggested by Stanley & Hopkins were selected for the final form.

(iv) For estimating the reliability of the test: The (a) Split-half and (b) Kuder-Richardson reliability methods were used. For calculating the Split-half,
Pearson’s Product Moment and Spearman-Brown Phrophecy formulae were used.

The formulae were as follows:

(a) Pearson’s Product Moment formula:

\[ r = \frac{N \sum X'Y' - \sum f X' \sum f Y'}{\sqrt{(N \sum f X'^2 - (\sum f X')^2) \times (N \sum f Y'^2 - (\sum f Y')^2)}} \]

Spearman-Brown Phrophecy formulae:

\[ r_{11} = \frac{2 r'_{11}}{1 + r'_{11}} \]

For estimating the reliability index of the present test, the following formula of (b)

(b) K-R 21 was adopted as given in Garrett\(^6\)

\[ r_{11} = \frac{n\sigma_t^2 - M (n-M)}{\sigma_1^2 (n-1)} \]

(v) For estimating the validity of the test: the following three methods were adopted:

a) **Content Validity** of the test was rated by the expert’s judgment.

b) **Concurrent Validity** was studied by correlating the present test scores with two external criterion tests: Ahuja Group test and Cattell’s Culture Fair Test and was calculated by Pearson’s Product Moment Method.

c) **Construct validity** of the test was studied by the Inter subtest Correlation and Factorial validity was verified by Thurstone’s Centroid Method. To estimate the internal consistency of the present test, the inter-subtests

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correlation among all ten subtests and the correlation of the sub-tests with the total were computed with the help of computer software Packages of social Sciences.

d) For Testing the Normality age-wise and class-wise: the normality of the distribution of the scores was calculated by the Mean, Median, Standard Deviation, $P_{10}$, $P_{90}$, Skewness and Kurtosis.

e) For establishing the Norms: Sigma Score or Z-Score, Percentile Score, T-Score, DIQ and Stanine score were used to derive for the test age-wise and class-wise.