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CHAPTER- V
CONSTRUCTION AND STANDARDIZATION OF INTELLIGENCE TEST

5.1 INTRODUCTION
The present chapter deals with evaluation of the items by experts, the various phases of try outs & item analysis. It also deals with preparation and administration of the final form of the test and establishment of norms for the test. Lastly reliability and validity of the Intelligence test has also been discussed.

5.2 CONSTRUCTION OF INTELLIGENCE TEST
The present investigator also kept some objective in mind that the Intelligence Test should be in verbal and non verbal form. the items are multiple-choice items, each of them having four distracters. The items of verbal form include verbal ability, reasoning ability, numerical ability and non verbal form include reasoning ability.

It has been decided to standardize the test on the population of Gujarat state upper primary school going students. The characteristics of the test which were decided are as under:

❖ A test should be in verbal and non verbal form.
❖ Items included in the verbal part of test should be based on words and in non-verbal form of test should be based on figures and pictures.
5.2.1 Language of the Test

The Gujarati language has been used for the present test because the test is meant for the Gujarati speaking students of upper primary schools of Gujarat state.

5.2.2 Factors to be considered

The following factors also have been taken into consideration, while determining the length of the test.

1. Time factor
2. Fatigue factor

5.2.3 Direction for Administration of the Test

There was no problem in motivating the students of these age groups, as it was made very clear that the test was given to measure either intelligence or ability. Suitable instructions were prepared to explain the students what he was supposed to do with the items of the test. An appeal was prepared to elicit honest and frank responses. One item was provided for practice work.

5.2.4 Testing Material

The “Intelligence Test” has been constructed on the design discussed in this chapter which has been standardized to measure individual differences in the Intelligence of upper primary school students of Gujarat state. A booklet of test is needed for each student. The test administrator will need booklet of intelligence test, manual and scoring key.
Hence, the following testing material has been planned to develop along with construction and standardization of test.

(1) Intelligence Test
(2) Manual
(3) Ready Recknor for obtaining PR’S, T-scores and Categories of Intelligence.

5.3 CONSTRUCTION OF ITEMS FOR EXPERIMENTAL TRY-OUTS

This part of the chapter deals with the complete procedure of experimental tryouts, item selection and development of a final form of the test.

5.3.1 Assigning Weightage

The essential point was considered regarding weightage to be assigned to (1) each part of the test and (2) each type of the item in every part of the test.

For that the opinions were taken from various expert of psychology and educationalist. They opined that equal weightage to both the part i.e. verbal test & non-verbal test should be given. The weightage given by the experts is shown in the following table 5.1.
They opined that looking to the age and grade level of the students to be tested, there should be variation in weightage to be given to each type of items in every parts of the test.

**5.3.2 Preparation and Try-out of the Manuscript**

A pool of test-items was prepared in the verbal and non-verbal form. In verbal form there are words and in non-verbal form there are figures and pictures. At the initial stage, a manuscript consisting of 120 items were prepared. The manuscript is shown (vide appendix - 1.)
The said manuscript was tried out on a very small group of upper primary school students, teacher educators and experts in the field of psychology which are shown in the following table 5.2.

**TABLE-5.2**

**SAMPLE FOR THE MANUSCRIPT TRY OUT**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Different groups</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Students of Grade V, VI and VII (40+40+40)</td>
<td>120</td>
</tr>
<tr>
<td>2.</td>
<td>Teacher Educators</td>
<td>10</td>
</tr>
<tr>
<td>3.</td>
<td>Experts from Psychology field</td>
<td>05</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>135</strong></td>
</tr>
</tbody>
</table>

The objectives of the manuscript tryout were as under:

1. To see whether the students follow the instruction
2. To check whether the test items works well with the students.
3. To know whether the teacher educators and experts concerned have any other suggestions before the items were finalized.
4. To confirm whether the students follow the language of the items.
5. To check up if there is any ambiguity in any of the test items.

6. To determine whether the created test items were easy or difficult for the students to understand.

The teacher educators pointed out some of the ambiguities in the wording of items and some of them were traced out at the time of discussion with the experts. Statistical calculations are not involved at this stage. The modification done after this try out is given in the following table-5.3

**TABLE-5.3**

**MODIFICATIONS MADE AFTER THE MANUSCRIPT TRY-OUT**

<table>
<thead>
<tr>
<th>No. of Items in the Manuscript</th>
<th>No. of Items dropped</th>
<th>No. of Items modified</th>
<th>No. of Items selected for pre-pilot try out of the test</th>
</tr>
</thead>
<tbody>
<tr>
<td>120</td>
<td>19</td>
<td>05</td>
<td>101</td>
</tr>
<tr>
<td>6,11,14,24,</td>
<td></td>
<td></td>
<td>51,81,107,</td>
</tr>
<tr>
<td>31,40,45,51,</td>
<td></td>
<td></td>
<td>110,118,</td>
</tr>
<tr>
<td>53,59,69,73,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>84,92,95,96,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>102,111,116,</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

After scrutiny and modification of the manuscript try out, 101 items were selected for the pre-pilot administration.
5.3.3 Preparation & Pre-Pilot Try out of the test

General directions were prepared on first page of the pre-pilot form of the test. New serial numbers of the items were given and about 60 printed copies of pre-pilot try out were prepared. (vide appendix- 2)

The pre-pilot form of the test was administered with the following objectives.
1. To get an idea of the administration of the present test.
2. To know whether the language of the items is easy to understand.
3. To find out gross defects of an items.
4. To see effectiveness of distracters.
5. To be acquainted with the administration of the present group test.
6. To see whether the practice items serve the purpose.
7. To determine approximate time-limit.
8. To see whether the students understand problems and instructions properly, and
9. To understand the reactions of the students on the problem-items

The pre-pilot try-out of the test was administered to the students of Grade V, VI and VII because the indices of difficulty and of discriminative power of the items and the attractiveness of the
distracters for the pilot try out are all dependent on the characteristics of the sample of examinees tested.

The classification of items for each type of numerical ability, reasoning ability and numerical ability part of verbal test in pre-pilot try out is given in the following table-5.4

**TABLE 5.4**

**TOTAL NO. OF ITEMS FOR EACH TYPE OF ABILITY IN PRE-PILOT FORM OF VERBAL TEST**

<table>
<thead>
<tr>
<th>Ability Components of Intelligence</th>
<th>Sr. No. of Items</th>
<th>Total no. of Items</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Type of Verbal Ability</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1. Ability to select word having antonym when words are given</td>
<td>1 to 13</td>
<td>13</td>
</tr>
<tr>
<td><strong>2. Type of reasoning ability</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1. Ability to select an analogous word by comparing the relationship of a given words.</td>
<td>14 to 27</td>
<td>14</td>
</tr>
<tr>
<td><strong>3. Type of numerical ability</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.1. Ability to select a missing number from number series which is given.</td>
<td>28 to 36</td>
<td>09</td>
</tr>
<tr>
<td>3.2. Ability to solve mathematical problems.</td>
<td>37 to 50</td>
<td>14</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>
The classification of items for each type of reasoning ability part of non-verbal test in pre-pilot try out is given in the following table-5.5

**TABLE 5.5**
TOTAL NO. OF ITEMS FOR EACH TYPE OF REASONING ABILITY PART IN PRE-PILOT TRY OUT OF NON-VERBAL TEST

<table>
<thead>
<tr>
<th>Type of reasoning ability</th>
<th>Sr. no. of items</th>
<th>Total no. of items</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Concepts involving counting of divided figures &amp; its number.</td>
<td>51 to 64</td>
<td>14</td>
</tr>
<tr>
<td>2. Concept involving the counting of geometrical figures in a given complex figure.</td>
<td>65 to 78</td>
<td>14</td>
</tr>
<tr>
<td>3. Concept involving searching an image of an object as seen in mirror for given object.</td>
<td>79 to 92</td>
<td>14</td>
</tr>
<tr>
<td>4. Concept involving to choose the part to complete the figure.</td>
<td>93 to 101</td>
<td>09</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>51</strong></td>
</tr>
</tbody>
</table>

Gender, Grade and Area wise sample selected for pre-pilot try out is given in the following table-5.6
TABLE 5.6
GENDER, GRADE AND AREA -WISE STUDENTS FOR PRE-PILOT TRY OUT

<table>
<thead>
<tr>
<th>Grade</th>
<th>Urban</th>
<th>Rural</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Boys</td>
<td>Girls</td>
<td>Boys</td>
</tr>
<tr>
<td>V</td>
<td>05</td>
<td>05</td>
<td>05</td>
</tr>
<tr>
<td>VI</td>
<td>05</td>
<td>05</td>
<td>05</td>
</tr>
<tr>
<td>VII</td>
<td>05</td>
<td>05</td>
<td>05</td>
</tr>
<tr>
<td>Total</td>
<td>15</td>
<td>15</td>
<td>15</td>
</tr>
</tbody>
</table>

The sample consisted of 60 upper primary school students for pre-pilot try-out. The test was administered on 30 boys and 30 girls; sufficient time was given to complete the work.

It was observed by the investigator personally that during the administration of the test, some of the naughty students disturbed other students. While some of them have marked the same answer for all the item. Some of the booklets were found incomplete which were discarded.

Out of 101 items, 96 items were selected for pilot try-out. 05 items were rejected. The number of items were selected for pilot try-out is given in the following table 5.7
### TABLE – 5.7

**SELECTION OF ITEMS FOR PILOT TRY-OUT**

<table>
<thead>
<tr>
<th>Item no.</th>
<th>Selected(S)/Rejected(R)</th>
<th>New no.</th>
<th>Item no.</th>
<th>Selected(S)/Rejected(R)</th>
<th>New no.</th>
<th>Item no.</th>
<th>Selected(S)/Rejected(R)</th>
<th>New no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>S</td>
<td>1</td>
<td>35</td>
<td>S</td>
<td>34</td>
<td>69</td>
<td>S</td>
<td>66</td>
</tr>
<tr>
<td>2</td>
<td>S</td>
<td>2</td>
<td>36</td>
<td>S</td>
<td>35</td>
<td>70</td>
<td>S</td>
<td>67</td>
</tr>
<tr>
<td>3</td>
<td>S</td>
<td>3</td>
<td>37</td>
<td>R</td>
<td>-</td>
<td>71</td>
<td>S</td>
<td>68</td>
</tr>
<tr>
<td>4</td>
<td>S</td>
<td>4</td>
<td>38</td>
<td>S</td>
<td>36</td>
<td>72</td>
<td>S</td>
<td>69</td>
</tr>
<tr>
<td>5</td>
<td>S</td>
<td>5</td>
<td>39</td>
<td>S</td>
<td>37</td>
<td>73</td>
<td>R</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td>S</td>
<td>6</td>
<td>40</td>
<td>S</td>
<td>38</td>
<td>74</td>
<td>S</td>
<td>70</td>
</tr>
<tr>
<td>7</td>
<td>S</td>
<td>7</td>
<td>41</td>
<td>S</td>
<td>39</td>
<td>75</td>
<td>S</td>
<td>71</td>
</tr>
<tr>
<td>8</td>
<td>S</td>
<td>8</td>
<td>42</td>
<td>S</td>
<td>40</td>
<td>76</td>
<td>S</td>
<td>72</td>
</tr>
<tr>
<td>9</td>
<td>S</td>
<td>9</td>
<td>43</td>
<td>S</td>
<td>41</td>
<td>77</td>
<td>S</td>
<td>73</td>
</tr>
<tr>
<td>10</td>
<td>S</td>
<td>10</td>
<td>44</td>
<td>S</td>
<td>42</td>
<td>78</td>
<td>S</td>
<td>74</td>
</tr>
<tr>
<td>11</td>
<td>S</td>
<td>11</td>
<td>45</td>
<td>S</td>
<td>43</td>
<td>79</td>
<td>S</td>
<td>75</td>
</tr>
<tr>
<td>12</td>
<td>S</td>
<td>12</td>
<td>46</td>
<td>S</td>
<td>44</td>
<td>80</td>
<td>S</td>
<td>76</td>
</tr>
<tr>
<td>13</td>
<td>S</td>
<td>13</td>
<td>47</td>
<td>S</td>
<td>45</td>
<td>81</td>
<td>S</td>
<td>77</td>
</tr>
<tr>
<td>14</td>
<td>S</td>
<td>14</td>
<td>48</td>
<td>S</td>
<td>46</td>
<td>82</td>
<td>S</td>
<td>78</td>
</tr>
<tr>
<td>15</td>
<td>S</td>
<td>15</td>
<td>49</td>
<td>S</td>
<td>47</td>
<td>83</td>
<td>S</td>
<td>79</td>
</tr>
<tr>
<td>16</td>
<td>S</td>
<td>16</td>
<td>50</td>
<td>S</td>
<td>48</td>
<td>84</td>
<td>S</td>
<td>80</td>
</tr>
<tr>
<td>17</td>
<td>S</td>
<td>17</td>
<td>51</td>
<td>S</td>
<td>49</td>
<td>85</td>
<td>S</td>
<td>81</td>
</tr>
</tbody>
</table>
Out of 101 items, 96 items were selected for pilot try out.

5.3.4 Preparation & Pilot Try out of the test

While selecting pilot test material, the observations and results of the pre-pilot were thoroughly reviewed. The following points were particularly considered:
1. The choices in verbal test and non-verbal test were done with special care for the pilot test booklets.
2. The items with weak distracters were dropped.
3. In some of items slight modification in distracters were made with a view to make the items more effective.
4. Running serial numbers were given to the test items.
5. After item distracter, many items were removed and remaining are arranged in ascending order of difficulty level.
6. The order of distracters was changed in the items, keeping in view the order of correct answers of adjoining items.
7. Instructions for the pilot test were finalized.
8. Tests were prepared and printed in the form of test booklets.

Necessary corrections, additions, omissions and modifications have been made on the basis of the results of the pre-pilot tryout. New serial no. of the items were given and about 500 printed copies of pilot-tryout were prepared (vide appendix-3)

The classification of items included in the pilot form of the intelligence test is given in the following table 5.8
TABLE – 5.8
CLASSIFICATION OF ITEMS SELECTED FOR THE PILOT FORM OF THE TEST

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Ability Components of Intelligence</th>
<th>Item No.</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A.</strong></td>
<td><strong>VERBAL PART</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Type of verbal ability</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1</td>
<td>Ability to select word having antonym when words are given.</td>
<td>1 to 13</td>
<td>13</td>
</tr>
<tr>
<td>2.</td>
<td>Type of reasoning ability</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1</td>
<td>Ability to select an analogous word by comparing the relationship of a given words</td>
<td>14 to 26</td>
<td>13</td>
</tr>
<tr>
<td>3.</td>
<td>Type of numerical ability</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.1</td>
<td>Ability to select a missing number from number series which is given.</td>
<td>27 to 35</td>
<td>9</td>
</tr>
<tr>
<td>3.2</td>
<td>Ability to solve mathematical problems</td>
<td>36 to 48</td>
<td>13</td>
</tr>
<tr>
<td><strong>Total no. of items for Verbal part</strong></td>
<td></td>
<td><strong>48</strong></td>
<td></td>
</tr>
<tr>
<td><strong>B.</strong></td>
<td><strong>NON VERBAL PART</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Types of reasoning ability</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1</td>
<td>Concepts involving counting of divided figures &amp; its number.</td>
<td>49 to 61</td>
<td>13</td>
</tr>
<tr>
<td>1.2</td>
<td>Concept involving the counting of geometrical figures in a given complex figure.</td>
<td>62 to 74</td>
<td>13</td>
</tr>
</tbody>
</table>
5.3.4.1 Administration of the Pilot try-out of the test

From the table 5.8, it was observed that from verbal test 48 items and from non-verbal test 48 items have been selected. Thus in all 96 items have been included in the pilot test. The objectives of pilot test which were kept in mind during administration are as follows:

1. To see whether students comprehend instructions or not.
2. To check the reactions of the students to the pilot test which is prepared after due modifications and corrections.
3. To collect data for item analysis.
4. To get idea about approximate time required for each part of the test.
5. To select items for the final form of the test after item analysis.
6. To get acquainted with the use of window key for scoring.

For the proper administration one has to take care of (1) time-limit (2) instructions for the test (3) selection of the sample for pilot test and (4)scoring the test.

<table>
<thead>
<tr>
<th>1.3</th>
<th>Concept involving searching an image of an object as seen in mirror for given object.</th>
<th>75 to 87</th>
<th>13</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.4</td>
<td>Concept involving choosing the part to complete the figure.</td>
<td>88 to 96</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td><strong>Total no. of items for Non verbal part</strong></td>
<td>48</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Total test items</strong></td>
<td>96</td>
<td></td>
</tr>
</tbody>
</table>
5.3.4.2 Time-Limit

The time-limit for the test, Verbal part includes (1) verbal ability part, (2) reasoning ability part and (3) numerical ability part. Non-verbal part as one part reasoning ability part. It was decided to give sufficient time to answer the test items. The time ranges from 90-95 minutes which is about three periods of a school time-table.

5.3.4.3 Instructions for the test Administration

In pilot testing instructions should be nearly identical with those to be used for the final form. From the observations of pre-pilot test, the instructions were prepared with due modifications whenever necessary. If necessary, instructions about the manner of responding the test items may be shown on black board at the initial stage of test administration.

(1) Verbal test: In verbal test students don't have problems to understood and could do it.

(2) Non-verbal Test: The items of non-verbal test became precise, exact and specified. It should be read clearly and slowly.

5.3.4.4 Selection of the Sample for Pilot try-out

The test has been given to 373 upper primary school students of 10 districts of Gujarat state. Care was taken to give appropriate representation to Grade (V,VI,VII) and Gender (boys and girls)and area (Urban, Rural) which is shown in the following table 5.9
TABLE-5.9
GENDER, GRADE AND AREA-WISE STUDENTS FOR PILOT TRY OUT

<table>
<thead>
<tr>
<th>Grade</th>
<th>Urban Boys</th>
<th>Urban Girls</th>
<th>Rural Boys</th>
<th>Rural Girls</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>V</td>
<td>30</td>
<td>30</td>
<td>33</td>
<td>30</td>
<td>123</td>
</tr>
<tr>
<td>VI</td>
<td>33</td>
<td>33</td>
<td>30</td>
<td>30</td>
<td>126</td>
</tr>
<tr>
<td>VII</td>
<td>31</td>
<td>31</td>
<td>31</td>
<td>31</td>
<td>124</td>
</tr>
<tr>
<td>Total</td>
<td>94</td>
<td>94</td>
<td>94</td>
<td>91</td>
<td>373</td>
</tr>
</tbody>
</table>

5.3.4.5 Scoring the Test

All the completed 373 answer-sheets were scored with the help of window-scoring key (vide appendix-5). Total number of right responses was calculated for each answer-sheet separately.

5.4 ITEM ANALYSIS

In conducting item analysis, the basic procedure is to compare the responses of a high scoring group with that of a low scoring group. The two characteristics usually determined for a test item are difficulty value and discriminative index. Ross (1963) writes "How hard is the item for the group tested, and how well does it distinguish between the more able and the less able students are two essential considerations. These two aspects of an item are nearly independent of each other, the exception being that a very easy or very hard item cannot discriminate well".
The objectives of item analysis are as follows:

(1) To discriminate between high and low scoring group.
(2) To select the valid items for final test.
(3) To arrange the selected items according to their difficulty levels in final form of the test.

In previous try-outs the objective was to remove ambiguities, but this being the final stage for selection of items, statistical calculations should be involved to check all items.

The procedure for items analysis of the present test includes the following techniques.

(1) Computation of difficulty value of items to study item-difficulty.
(2) Obtaining discriminative index of items to observe item validity.
(3) Distracters analysis.

Above mentioned techniques has been discussed and employed for the present test as under:

**5.4.1 Difficulty Value**

The major reason for measuring difficulty value of item is to discard items of unsuitable difficulty level. **Guilford (1954) writes**, “We do not have accurate information concerning an item's difficulty. All we know is that if he passes it, the item is less difficult than his ability to cope with it, and if he fails it, the item is more difficult than his ability to cope with it." Obviously if no one passes an item, it is only excess baggage in the test. The same is true for items that
everyone passes. Neither of these types of item provides any information about individual differences. Since such item does not affect the variability of test scores, they contribute nothing to the reliability or validity of the test.

According to T.L. Kelley (1939) method the following steps were find out the difficulty value of items.

1. 373 answer-sheets of students in the sample were taken.
2. The answer-sheets were arranged in the ascending order of total scores.
3. 27% (i.e.100) of the answer-sheets from the top were considered in the "Upper Group" (U.G).
4. 27% (i.e.100) of the answer-sheets from the bottom were considered in the "Lower Group" (L.G).
5. Item-wise correct responses in the answer-sheets of U.G. and L.G. was calculated.

From the data thus obtained difficulty value of each item was calculated by using the following formula:

\[
\text{Difficulty Value} = \frac{U + L}{N}
\]

When,  \(U\) = Correct responses for the item by U.G.

\(L\) = Correct responses for the item by L.G.

\(N\) = Total number of students of U.G. and L.G.

The results of difficulty values have been shown in table No.5.10
5.4.2 Discriminative Index

A second fundamental index is discriminating power of the item or item validity or internal consistency of item. If the number of students passing each item in U and L criterion groups are expressed as proportions, the difference between these two proportions provides an index of item validity and is represented by discriminative index. The data were calculated by using the following formula:

\[
\text{Discriminative Index} = (P_u - P_L) \frac{1}{2} N
\]

When, 
\[
P_u = \text{Proportions of correct response for the item by U.G.}
\]
\[
P_L = \text{Proportions of correct responses for the item by L.G.}
\]
\[
N = \text{Total number of students of U.G. and L.G.}
\]

The results of discriminative index have been shown in table no.5.10

The estimated difficulty values and discriminative index of each item of verbal and non verbal part of intelligence test is shown in the following table 5.10
TABLE 5.10
DIFFICULTY VALUE AND DISCRIMINATIVE INDEX
FOR ITEMS OF PILOT TRY OUT OF
INTELLIGENCE TEST

<table>
<thead>
<tr>
<th>Item no.</th>
<th>Discriminative Index</th>
<th>Difficulty Value</th>
<th>Selected/Rejected</th>
<th>New No.</th>
</tr>
</thead>
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<td>S</td>
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5.4.3 Distracter Analysis

The formula for correction of chance was not applied to individual's score in the pilot test for following reasons:

(1) All the items are multiple-choice items, each of them having four distracters. Anastasi writes, “Multiple-choice items have proved to be most widely applicable. They are also easier to score than certain other forms, and reduce the chances of correct guessing by presenting several alternative responses”\(^6\)

(2) Sufficient time was given to all the students to complete the test

(3) Only the test booklets of the students who had attempted all the items were taken for purpose of item analysis.

With a view to study responses given to each of the distracter, investigator scored 200 answer-sheets part-wise for further analysis. The number of students who choose each alternative in answering each and every item were recorded shown in table 5.11
### TABLE 5.11
DISTRACTER ANALYSIS OF THE ITEMS OF PILOT FORM OF INTELLIGENCE TEST

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<th>Total</th>
<th>New No</th>
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<td>c</td>
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<td>14</td>
<td>70</td>
<td>0</td>
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<td>5</td>
<td>2</td>
<td>84</td>
<td>0</td>
</tr>
</tbody>
</table>
Table 5.11 shown the distracter analysis of pilot try-out items. Out of 101 items, 96 items were selected for pilot tryout. Thus the distracter analysis served as an x-ray screening in the process of finalizing the final run of the test.
From the distracter analysis, it was observed that some of the answers, pictures and figures require exactness. Even some of the problem-statements require clarity of language, which were carefully changed before final run of the test.

5.4.4 Observations During Pilot Testing

The following observations were made by the investigator during the administration of the pilot form of the test.

1. Instructions were properly followed by the students.
2. Students had no difficulty in understanding the items.
3. One-practice item in verbal part in each type of ability component and one practice item in non verbal part in reasoning ability component have been found to be enough to acquaint the students with the method of answering.
4. Printed test booklets and separate answer sheet were found to be convenient to the students.
5. Students showed interest in taking the test.
6. Administration of the test procedure was found smooth and quick.

5.5 SELECTION OF ITEMS FOR THE FINAL TRY OUT OF THE TEST

The table 5.12 gives clear idea of the selection of items. The items were selected for the final run of the test on the basis of the given data. Criteria for the selection of the items were fixed as under.
1. The items, whose discriminative index were found to be between 0.20 to 0.80 were selected.

2. The items, whose difficulty values were found to be between 0.20 to 1.00 were selected.

In the beginning, the items whose discriminative index were not found to be 0.20 to 0.80 and the items whose difficulty values were not found to be 0.20 to 1.00, they were also discarded. The items for the final form were then selected. Thus 26 items were found to be having low discriminative index or low difficulty values and so they were discarded. Rest of the 70 items were selected for the final form of the intelligence test.

The classification of items selected for verbal and non-verbal part in final form of the intelligence test is given in the following table 5.12

**TABLE 5.12**

**ITEMS SELECTED FOR FINAL TRY OUT OF THE TEST.**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Ability Components of Intelligence</th>
<th>Item No.</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.</td>
<td><strong>VERBAL PART</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Type of verbal ability</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1</td>
<td>Ability to select word having antonym when words are given.</td>
<td>1 to 10</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Type of reasoning ability</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>--------------------------------------------------------</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Ability to select an analogous word by comparing the relationship of a given words</td>
<td>11 to 20</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>Type of numerical ability</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.1</td>
<td>Ability to select a missing number from number series which is given.</td>
<td>21to 25</td>
<td>5</td>
</tr>
<tr>
<td>3.2</td>
<td>Ability to solve mathematical problems</td>
<td>26 to 35</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td><strong>Total no. of items for Verbal part</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>35</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NON VERBAL PART**

<table>
<thead>
<tr>
<th></th>
<th>Type of reasoning ability</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Concepts involving counting of divided figures &amp; its number.</td>
<td>36 to 45</td>
</tr>
<tr>
<td>1.2</td>
<td>Concept involving the counting of geometrical figures in a given complex figure.</td>
<td>46 to 55</td>
</tr>
<tr>
<td>1.3</td>
<td>Concept involving searching an image of an object as seen in mirror for given object.</td>
<td>56 to 65</td>
</tr>
<tr>
<td>1.4</td>
<td>Concept involving choosing the part to complete the figure.</td>
<td>66 to 70</td>
</tr>
<tr>
<td></td>
<td><strong>Total no. of items for Non verbal part</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>35</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Total no. of test items</strong></td>
<td>70</td>
</tr>
</tbody>
</table>
5.6 FINAL RUN OF THE TEST FOR STANDARDIZATION, ESTABLISHMENT OF NORMS, RELIABILITY AND VALIDITY OF THE TEST

5.6.1 Printing of Test Booklets

After the process of selection and arrangement of items according to difficulty value, the next step was administration of final run of the test. As the test has to be administered over a large sample representing three grades including boys and girls, it was essential that the test should be carefully printed.

The final form of the test was printed. (vide Appendix 4.) As the test was to be administered on a sample of about 4500 upper primary students of Gujarat state about 1,000 test booklets along with 4500 answer sheets were printed. The design of answer-sheet was so planned that the students could easily understand. In order to fill up necessary particulars by testees viz. name, birth date, name of school, grade level, area of school etc., blank space were kept in answer-sheet.

5.6.2 Preparation of Directions for Final Run of test

From the try-outs, it was observed that there was no need to make any changes in general instructions. The general instructions prepared and used during the pilot administration were found to be clear and useful. The specific instructions for the testees, questions, answers in verbal test and non-verbal test were prepared for the final
run. There was no specific change in instructions for all parts, except assigning time limit.

In the present test, the detailed instructions in Gujarati language are given. The students understand Gujarati language well. The tester should read loudly, slowly and clearly. Thus the directions for administration of the test were prepared with great care and accuracy.

5.6.3 Time Limit

It was most essential to give enough time to complete all the 70 items to all the students. It was observed by the investigator that most of the students could complete all answers within 60 minutes. However, the time to read for instructions and to fill up the personal bio-data has been not included in the time limit. Considering this preliminary time along with the time noted, it has been observed that the entire work can be complete within 60 to 65 minutes.

5.6.4 Correction for Guessing

Whenever there are choices in the items, there is possibility of chance for guessing. The guessing decreases as the number of choices increases, it means in true false items, the chance of guessing is greater than that in the multiple-choice items. This has been discussed with due reference in the previous chapter. Whenever there are multiple-choice types of items with four or more distracters, Ross and Stanley (1963) recommended that formula for chance-correction does not need to be applied. As in the present test there are four
distracters it was decided that chance formula need not be applied and the norms would be established from the Students' scores without correction.

Thus, the test was administered on the representative sample of the students of primary schools. The incomplete or partly filled answer-sheets were rejected. While the remaining answer-sheets were scored with all possible care, the raw-scores thus obtained were ready for further computations in the process of standardization.

5.6.5 Population

A population may be defined as any identifiable groups of individuals or as any collection or aggregate of comparable measures. A sample is any member of the population that has been selected to represent that population. In the ordinary usage, populations are usually thought of as consisting of human being; in the statistical sense, population may consist of any kind of members whatever.

Kubir Singh Sidhu (1985) described population in the following words “By population we mean that aggregate or totality of objects or individuals regarding which inference are made in a sampling study. It means all those people or documents etc. who are proposed to be covered under the scheme of study. A population is any group of individuals that have one or more characteristics in common that are interest to researcher.”
Borg and Gall (1983) defined population in the following manner: “By population or universe we mean all the members of a real or hypothetical set of people, events or objects to which we wish to generalize the results of our research.”

After defining the population, two conditions governing the adequacy of the sample are to be satisfied:

1. The sample should be representative of the population for which the test is designed.
2. The sample should be numerically adequate to give statistically valid and reliable results.

Population of the present study is total no. of students studying in upper primary schools of different districts of Gujarat in academic year 2009-2010 is given in the table 5.13
TABLE 5.13
DISTRICTWISE TOTAL NUMBER OF STUDENTS IN
UPPER PRIMARY SCHOOLS OF GUJARAT

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Name of Districts</th>
<th>Boys</th>
<th>Girls</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ahmedabad</td>
<td>163429</td>
<td>133172</td>
<td>296601</td>
</tr>
<tr>
<td>2</td>
<td>Amreli</td>
<td>48393</td>
<td>37508</td>
<td>85901</td>
</tr>
<tr>
<td>3</td>
<td>Anand</td>
<td>67477</td>
<td>53496</td>
<td>120973</td>
</tr>
<tr>
<td>4</td>
<td>Banaskantha</td>
<td>96820</td>
<td>69589</td>
<td>166409</td>
</tr>
<tr>
<td>5</td>
<td>Bharuch</td>
<td>47367</td>
<td>41932</td>
<td>89299</td>
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<tr>
<td>6</td>
<td>Bhavnagar</td>
<td>95579</td>
<td>80386</td>
<td>175965</td>
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<td>7</td>
<td>Dahod</td>
<td>59515</td>
<td>53944</td>
<td>113459</td>
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<td>8</td>
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<td>13526</td>
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<td>9</td>
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<td>35457</td>
<td>85115</td>
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<td>10</td>
<td>Jamnagar</td>
<td>47307</td>
<td>42315</td>
<td>89622</td>
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<tr>
<td>11</td>
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<td>90359</td>
<td>79760</td>
<td>170119</td>
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<td>Kheda</td>
<td>76668</td>
<td>60954</td>
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<td>49817</td>
<td>41059</td>
<td>90876</td>
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<td>15</td>
<td>Narmada</td>
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<td>36236</td>
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<td>16</td>
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<td>33718</td>
<td>30405</td>
<td>64123</td>
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<tr>
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<td>Panchmahal</td>
<td>Patan</td>
<td>Porbandar</td>
<td>Rajkot</td>
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<td>138392</td>
<td>66760</td>
<td>32453</td>
<td>154150</td>
</tr>
</tbody>
</table>

*District report card 2008-09, NUEPA, New Delhi.

**5.6.6 Selection of the Sample**

A psychological instrument should be viewed in the context of the population for which it is prepared. All tests are valid when used with the population for which they are standardized. Similarly, a single text may be used for different groups of population but the same score in different cases will carry a different meaning.

It is necessary that the population for which a test is meant to be used is defined before the actual work of standardization is undertaken. Not only is the determination of the size of the sample needed for standardization of the test is important but the investigator
of a test must decide at the outset with which group of, with what segment of the population his instrument is to be used. Secondly, the investigator has to select the size of the representative sample properly.

It means that the investigator has to select sample which is representative in terms of gender, area, age, and grade.

**Definition of representative sample**

Johnson says (1969) "A representative sample is defined as one with which the measurement made on its units is equivalent to those which would be obtained by measuring all the elements of the population, except for the limited size of the sample".

According to Lindquist (1959) "It is a mistake to judge adequacy of a sample in terms of the number of pupils tested. However the schools as well as the children must be taken into account".

There are various methods of sampling. These methods are (1) Random Sampling, (2) Stratified Sampling, (3) Area Sampling, (4) Systematic Sampling, (5) Purposive Sampling, and (6) Quota Sampling.

In the present study the stratified random sampling method has been used for selecting the sample.

According to Garrett (1965) "Stratified or Quota Sampling (also called Controlled Sampling) is a technique designed to ensure
representations and avoid biases by use of a modified random sampling method”.

According to Guilford (1956) “It is a procedure that is introduced in sampling which help to prevent biases and also to assure a more representative sample know as stratification”.

From population, the representative sample was selected by stratified random sampling method. The distribution of 4414 students belonging to age group 10-14 were tested from Grades V to VII of upper primary schools of Gujarat in academic year 2009-2010 is shown in table 5.14

**TABLE 5.14**

**GRADE, AREA AND GENDER WISE DISTRIBUTION OF THE SAMPLE**

<table>
<thead>
<tr>
<th>Grade</th>
<th>Urban Area</th>
<th>Rural Area</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Boys</td>
<td>Girls</td>
<td>Total</td>
</tr>
<tr>
<td>V</td>
<td>394</td>
<td>338</td>
<td>732</td>
</tr>
<tr>
<td>VI</td>
<td>442</td>
<td>308</td>
<td>750</td>
</tr>
<tr>
<td>VII</td>
<td>365</td>
<td>247</td>
<td>612</td>
</tr>
<tr>
<td>Total</td>
<td>1201</td>
<td>893</td>
<td>2094</td>
</tr>
</tbody>
</table>
5.6.7 Administration of the test

The test was administered to a group of representative sample after the test booklets and answer-sheets being printed and the directions for administration of the test being prepared. The test was administered to the students of age group 10-14 years of upper primary schools in different districts of the Gujarat state.

Most of the students and teachers were found to be aware of the importance of testing program. Hence, the investigator do not have to face more difficulties in getting co-operation from the principles, supervisors, teachers and students of the primary schools of the Gujarat.

Regarding physical facilities influence on the achievement of score, care was taken to get proper facilities. Whenever the test was administered proper seating arrangements in spacious hall with enough benches and good ventilation were provided to students.

5.6.8 Scoring of the test

After the test being administered, the next step to follow is scoring. It is a laborious and time-consuming task. As there are separate answer-sheets, scoring was done from the answer-sheets. In order to ensure speed and accuracy in scoring the test, various types of scoring keys are in use. The types of scoring keys are as follows: (1) strip key, (2) window scoring (3) carbon or pinpricks, and (4) machine scoring stencils.
Out of all these scoring keys, the use of window scoring was found suitable (vide Appendix 5). However, there is one limitation of the use of window scoring and that is regarding double marked answers for a single item. To avoid this due precaution was taken to see if there was more than one mark to indicate the answer. Such items were discarded before the use of window stencils for scoring. Thus, all the answer-sheets were scored and the number of correct items (i.e. the raw scores) was written in the space provided in the answer-sheets. From the raw scores, the total of the raw scores were noted in the column at the top of answer-sheets.

5.6.9 Frequency Distribution of Total Sample

The total sample of IQ of 4414 upper primary students were distributed in frequency distribution table and mean, median, S.D, Q1, Q2, Q3, P10, P90, Skewness, Kurtosis were computed which is given in the following table 5.15
TABLE 5.15
FREQUENCY DISTRIBUTION OF SCORE OF INTELLIGENCE OF TOTAL SAMPLE

<table>
<thead>
<tr>
<th>Class interval (I.Q.Scores)</th>
<th>Original Frequency</th>
<th>Smoothen Frequency</th>
<th>Computed Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>61-70</td>
<td>15</td>
<td>107</td>
<td>Mean : 34.13</td>
</tr>
<tr>
<td>51-60</td>
<td>290</td>
<td>496</td>
<td>Median : 32.16</td>
</tr>
<tr>
<td>41-50</td>
<td>1168</td>
<td>910</td>
<td>S.D : 3.99</td>
</tr>
<tr>
<td>31-40</td>
<td>1270</td>
<td>1150</td>
<td>Q1 : 15</td>
</tr>
<tr>
<td>21-30</td>
<td>1012</td>
<td>960</td>
<td>Q2 : 39.67</td>
</tr>
<tr>
<td>11-20</td>
<td>599</td>
<td>571</td>
<td>Q3 : 12.33</td>
</tr>
<tr>
<td>1-10</td>
<td>61</td>
<td>220</td>
<td>P_{10} : 0</td>
</tr>
<tr>
<td>Total</td>
<td>4414</td>
<td>4414</td>
<td>P_{90} : 54.1</td>
</tr>
</tbody>
</table>

The frequency distribution of total sample is graphically presented in Graph 1.

The skewness of the curve is found to be -0.095 which shows that the distribution is negatively skewed.

The Kurtosis for the given distribution was calculated. Kurtosis is found to be 0.228. As the value of kurtosis is less than 0.263 the distribution is leptokurtosis which is also seen from Graph 1.
GRAPH-1

FREQUENCY DISTRIBUTION OF INTELLIGENCE SCORES

The graph shows the frequency distribution of intelligence scores for different class intervals. It compares the original frequency distribution with a smoothened frequency distribution.
5.7 THE NORMS OF THE PRESENT TEST

In the process of standardizing a test, it is administered to a large, representative sample of the type of subjects for whom it is designed. This group is known as the standardization sample serves to establish the norms. Although norms indicate the average performance, it was also the relative frequency of varying degrees of deviation above and below the average. The scores on psychological tests are most commonly interpreted by referring to norms, which represent test performance of the standardization sample.

**Anastasi (1965) has defined as:** "As its name implies a norm is the normal or average performance".

According to Brown, "A comparison of individual's performance to the performance of some reference group, called a norm group are known as norms”

**According to Lyman(1963)** "Norms are the results obtained by a specified group on a specified test. Norms provide a standard against which we may compare any given raw score value”. Lyman suggests four major categories as classification of norms which are as follows:

1. Comparison with an absolute standard e.g. percentage of correct responses or letter grades.
(2) Inter-Individual comparison like linear standard scores viz. Z-scores, T-scores, Deviation IQs, Percentile Ranks etc.

(3) Inter-Individual comparison, like Ratio-IQs, Educational Quotients.

(4) Assorted Arbitrary Bases, e.g. Otis-Style Deviation IQs.

Freeman (1960) writing about qualitative and quantitative interpretation of the test scores states, "To facilitate interpretation, psychological tests provide table of age-norms or grade norms or percentile ranks or deciding ranks or standard scores".

Thorndike and Hagen have suggested four main types of norms for psychological tests. They are:

(1) Age Norms
(2) Grade Norms
(3) Percentile Norms
(4) Standard Score Norms

The following norms have been decided to establish for the present test. They are as follows:

(1) Age Norms (2) Grade Norms (3) Gender Norms (4) Area Norms
(5) Percentile Ranks (6) Deviation IQs.

Age norms or grade norms are given mostly with standardized test. Sometime sex norms are also computed. Freeman has suggested, “Grade norms have been used less frequently with intelligence tests
than with educational tests. Their interpretation is much more ambiguous than is the interpretation of age norms”.

As the present test has been developed for students of age group 10-14 years who are studying in Grade V, VI & VII of primary school of Gujarat state if the grade norms are given it will be convenient to compare individual as well as average performance of the students of particular standards. Hence it was decided to compute age norms and grade norms both.

Next step was to decide whether gender norms should be fixed or not but it has been observed by researchers that gender differences in intelligence are negligible. But divergent views prevail among test construction. Terman (1969) quotes that, "There are slight gender differences up to the age of thirteen, while York and Foster are of the opinion that on the basis of total score for the entire test, no significant gender differences can be made.

From the above quotation, it was observed that there might not be gender differences at the age of fourteen. However, it was decided to compute the raw scores gender-wise & grade-wise, and to study the significance of gender differences for the present test and if significant differences are traced out, separate gender norms are to be fixed.
The calculation of different types of norms are describe in detail as follows

**5.7.1 Age Norms**

Age norms can be defined as the average performance of students at various age levels. This type of norms is established by administering the test to a large representative group of students of various age levels. The mean, median and standard deviation are computed. The average or median score for each age level is called the age norms. The age norms have certain limitations which are as follows:

(1) It is very different to interpret very high scores or very low scores with age norms. To interpret such scores extrapolation has to be made and this involves about dubious assumptions.

(2) Age norms largely depend upon the age at schools entrance. The ages that are entered into the school register are supposed to be the exact age, which in the reality may not be so. Therefore, age norms based on such data may be ambiguous.

To overcome these limitations of the age norms, it has been practice to establish percentile norms and standard score norms for test. To establish age norms, the answer sheets of the students were classified into group of one-year average each and the frequencies of the scores were calculated into each group separately.
Since population tested ranges widely in age, there would be different age groups. To represent different age groups, the age ranges were determined as shown in Table 5.16

**TABLE: 5.16**

**AGE GROUP AND ITS AGE RANGE**

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Age Ranges</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>9.6 to 10.5</td>
</tr>
<tr>
<td>11</td>
<td>10.6 to 11.5</td>
</tr>
<tr>
<td>12</td>
<td>11.6 to 12.5</td>
</tr>
<tr>
<td>13</td>
<td>12.6 to 13.5</td>
</tr>
<tr>
<td>14</td>
<td>13.6 to 14.5</td>
</tr>
</tbody>
</table>

Hereafter, the age groups will be referred to represent respective age ranges as shown above. In order to calculate age norms, the answer sheet of 4414 students was classified according to each age group and age wise frequency distribution of total sample was prepared. The frequency distribution of I.Q. scores of students belonging to each age group is shown in table 5.17
### TABLE 5.17

**AGE-WISE FREQUENCY DISTRIBUTION OF I.Q SCORES**

<table>
<thead>
<tr>
<th>Class Interval (I.Q. Scores)</th>
<th>Age group</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>9.6-10.5</td>
<td>10.6-11.5</td>
<td>11.6-12.5</td>
<td>12.6-13.5</td>
<td>13.6-14.5</td>
<td></td>
</tr>
<tr>
<td>61-70</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>8</td>
<td>6</td>
<td>14</td>
</tr>
<tr>
<td>51-60</td>
<td>0</td>
<td>33</td>
<td>170</td>
<td>87</td>
<td>0</td>
<td>290</td>
</tr>
<tr>
<td>41-50</td>
<td>12</td>
<td>293</td>
<td>478</td>
<td>365</td>
<td>20</td>
<td>1168</td>
</tr>
<tr>
<td>31-40</td>
<td>39</td>
<td>219</td>
<td>504</td>
<td>478</td>
<td>30</td>
<td>1270</td>
</tr>
<tr>
<td>21-30</td>
<td>27</td>
<td>254</td>
<td>401</td>
<td>312</td>
<td>18</td>
<td>1012</td>
</tr>
<tr>
<td>11-20-</td>
<td>26</td>
<td>130</td>
<td>327</td>
<td>111</td>
<td>5</td>
<td>599</td>
</tr>
<tr>
<td>1.0-10</td>
<td>3</td>
<td>10</td>
<td>57</td>
<td>1</td>
<td>0</td>
<td>61</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>107</strong></td>
<td><strong>939</strong></td>
<td><strong>1927</strong></td>
<td><strong>1362</strong></td>
<td><strong>79</strong></td>
<td><strong>4414</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Median</th>
<th>S.D</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>28.39</td>
<td>29.57</td>
<td>19.79</td>
</tr>
<tr>
<td></td>
<td>33.52</td>
<td>34.23</td>
<td>8.67</td>
</tr>
<tr>
<td></td>
<td>33.53</td>
<td>34.24</td>
<td>8.06</td>
</tr>
<tr>
<td></td>
<td>35.69</td>
<td>35.88</td>
<td>7.17</td>
</tr>
<tr>
<td></td>
<td>42.72</td>
<td>36</td>
<td>11.82</td>
</tr>
<tr>
<td></td>
<td>34.77</td>
<td>35.88</td>
<td>3.99</td>
</tr>
</tbody>
</table>

The histogram of IQ scores of students of different age group is shown in Graph 2.
The necessary data to test the significance of difference between mean scores of IQ of different age group was calculated and shown in table 5.18
### TABLE 5.18

**SIGNIFICANCE OF DIFFERENCE BETWEEN THE MEAN SCORES OF STUDENTS OF DIFFERENT AGE GROUPS**

<table>
<thead>
<tr>
<th>Age</th>
<th>N</th>
<th>M</th>
<th>S.D</th>
<th>SED</th>
<th>t-Value</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>107</td>
<td>28.39</td>
<td>19.79</td>
<td></td>
<td>2.62</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>939</td>
<td>33.52</td>
<td>8.67</td>
<td>2.62</td>
<td>1.96**</td>
<td>significant</td>
</tr>
<tr>
<td>11</td>
<td>939</td>
<td>33.57</td>
<td>8.67</td>
<td></td>
<td>0.31</td>
<td>2.13**</td>
</tr>
<tr>
<td>12</td>
<td>1927</td>
<td>34.24</td>
<td>6.06</td>
<td></td>
<td>0.24</td>
<td>6.88*</td>
</tr>
<tr>
<td>13</td>
<td>1362</td>
<td>35.88</td>
<td>7.17</td>
<td></td>
<td>3.52</td>
<td>2.00**</td>
</tr>
</tbody>
</table>

* t value significant at 0.01 level=2.58
** t value significant at 0.05 level=1.96

From the table 5.18 it is observed that the t-value of the mean scores of IQ of students of different age group is significant at 0.01 and 0.05 level.

#### 5.7.2 Grade Norms

The students selected for the sample were from grade V, VI and VII. To establish the grade norms, the students of grade V, VI and VII were considered. The frequency distribution of students belonging to grade V, VI and VII is given in table 5.19
### TABLE 5.19
GRADEWISE FREQUENCY DISTRIBUTION
OF INTELLIGENCE SCORES

<table>
<thead>
<tr>
<th>Class Interval (I.Q.Scores)</th>
<th>Grade-V</th>
<th>Grade-VI</th>
<th>Grade-VII</th>
</tr>
</thead>
<tbody>
<tr>
<td>61-70</td>
<td>0</td>
<td>0</td>
<td>14</td>
</tr>
<tr>
<td>51-60</td>
<td>81</td>
<td>53</td>
<td>156</td>
</tr>
<tr>
<td>41-50</td>
<td>365</td>
<td>465</td>
<td>338</td>
</tr>
<tr>
<td>31-40</td>
<td>420</td>
<td>482</td>
<td>368</td>
</tr>
<tr>
<td>21-30</td>
<td>382</td>
<td>361</td>
<td>269</td>
</tr>
<tr>
<td>11-20</td>
<td>268</td>
<td>194</td>
<td>137</td>
</tr>
<tr>
<td>1.0-10</td>
<td>29</td>
<td>23</td>
<td>9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1545</strong></td>
<td><strong>1578</strong></td>
<td><strong>1291</strong></td>
</tr>
<tr>
<td>Mean</td>
<td>32.72</td>
<td>34.88</td>
<td>36.76</td>
</tr>
<tr>
<td>Median</td>
<td>33.37</td>
<td>36.76</td>
<td>37.40</td>
</tr>
<tr>
<td>S.D</td>
<td>6.81</td>
<td>6.68</td>
<td>7.37</td>
</tr>
</tbody>
</table>

The histogram of I.Q. scores of students of grade V, VI & VII is shown in Graph 3.
The necessary data to test the significance of difference between mean scores of I.Q. scores of different grades was calculated and shown in table 5.20
**TABLE 5.20**

**SIGNIFICANCE OF DIFFERENCE BETWEEN THE MEAN SCORES OF STUDENTS OF DIFFERENT GRADE**

<table>
<thead>
<tr>
<th>Grade</th>
<th>N</th>
<th>Mean</th>
<th>S.D</th>
<th>SED</th>
<th>t-value</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>V</td>
<td>1545</td>
<td>32.72</td>
<td>6.81</td>
<td>0.24</td>
<td>8.95*</td>
<td>significant</td>
</tr>
<tr>
<td>VI</td>
<td>1578</td>
<td>34.88</td>
<td>6.68</td>
<td></td>
<td>7.12*</td>
<td>significant</td>
</tr>
<tr>
<td>VII</td>
<td>1291</td>
<td>36.76</td>
<td>7.37</td>
<td>0.26</td>
<td></td>
<td></td>
</tr>
<tr>
<td>V</td>
<td>1545</td>
<td>32.72</td>
<td>6.81</td>
<td>0.30</td>
<td>13.30*</td>
<td>significant</td>
</tr>
</tbody>
</table>

* t value significant at 0.01 level = 2.58
** t value significant at 0.05 level = 1.96

From Table 5.20, it is observed that there is significant difference between the mean scores of students of different grade i.e. Grade V, VI and VII at 0.01 level.

Even though there is a significant difference between different grades, the mean value for each grade will be the **Grade Norms** for respective grade. So while establishing PR’s grade wise, there is no need to consider each grade.
5.7.3 Gender Norms

To study the effect of gender on IQ, the sample consists of boys and girls of grade V, VI and VII were taken into consideration. The gender wise frequency distribution of I.Q. score is shown in table 5.21.

**TABLE 5.21**

**GENDER WISE FREQUENCY DISTRIBUTION OF INTELLIGENCE SCORES**

<table>
<thead>
<tr>
<th>Class interval (I.Q.Scores)</th>
<th>Boys</th>
<th>Girls</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>61-70</td>
<td>8</td>
<td>6</td>
<td>14</td>
</tr>
<tr>
<td>51-60</td>
<td>230</td>
<td>60</td>
<td>290</td>
</tr>
<tr>
<td>41-50</td>
<td>548</td>
<td>620</td>
<td>1168</td>
</tr>
<tr>
<td>31-40</td>
<td>703</td>
<td>567</td>
<td>1270</td>
</tr>
<tr>
<td>21-30</td>
<td>560</td>
<td>452</td>
<td>1012</td>
</tr>
<tr>
<td>11-20-</td>
<td>345</td>
<td>254</td>
<td>599</td>
</tr>
<tr>
<td>1.0-10</td>
<td>44</td>
<td>17</td>
<td>61</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2438</strong></td>
<td><strong>1976</strong></td>
<td><strong>4414</strong></td>
</tr>
</tbody>
</table>

Mean: 34.06, 34.22, 34.77
Median: 34.34, 35.17, 35.87
S.D: 5.37, 5.96, 3.992

The histogram of boys and girls is shown in Graph 4.
The necessary data to test the significance of difference between mean scores of IQ of boys and girls was calculated and shown in table 5.22
TABLE 5.22
SIGNIFICANCE OF DIFFERENCE BETWEEN
THE MEAN SCORES OF INTELLIGENCE
OF BOYS AND GIRLS

<table>
<thead>
<tr>
<th>Gender</th>
<th>N</th>
<th>M</th>
<th>S.D</th>
<th>SED</th>
<th>t-value</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys</td>
<td>2438</td>
<td>34.06</td>
<td>5.37</td>
<td>0.17</td>
<td>0.93</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Girls</td>
<td>1976</td>
<td>34.22</td>
<td>5.96</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* t value significant at 0.01 level = 2.58
** t value significant at 0.05 level = 1.96

From Table 5.21, it is observed that gender difference don’t prevail. So there is no need to established separate norms for boys and girls.

5.7.4 Area Norms

The students selected for the sample were from urban and rural areas. The town places, taluka places and district head quarters were considered as urban areas and other places were considered as rural areas. The area wise frequency distribution of IQ score is shown in table 5.23.
TABLE 5.23

AREA WISE FREQUENCY DISTRIBUTION OF INTELLIGENCE SCORES

<table>
<thead>
<tr>
<th>Class interval (I.Q.Scores)</th>
<th>Urban</th>
<th>Rural</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>61-70</td>
<td>14</td>
<td>0</td>
<td>14</td>
</tr>
<tr>
<td>51-60</td>
<td>100</td>
<td>190</td>
<td>290</td>
</tr>
<tr>
<td>41-50</td>
<td>570</td>
<td>598</td>
<td>1168</td>
</tr>
<tr>
<td>31-40</td>
<td>606</td>
<td>664</td>
<td>1270</td>
</tr>
<tr>
<td>21-30</td>
<td>473</td>
<td>539</td>
<td>1012</td>
</tr>
<tr>
<td>11-20</td>
<td>298</td>
<td>301</td>
<td>599</td>
</tr>
<tr>
<td>1.0-10</td>
<td>33</td>
<td>28</td>
<td>61</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2094</strong></td>
<td><strong>2320</strong></td>
<td><strong>4414</strong></td>
</tr>
<tr>
<td>Mean</td>
<td>34.51</td>
<td>34.70</td>
<td>34.77</td>
</tr>
<tr>
<td>Median</td>
<td>35.93</td>
<td>35.82</td>
<td>35.87</td>
</tr>
<tr>
<td>S.D</td>
<td>5.80</td>
<td>5.50</td>
<td>3.992</td>
</tr>
</tbody>
</table>

The histogram of urban and rural area is shown in Graph 5.
The necessary data to test the significance of difference between mean scores of IQ of different areas was calculated and shown in table 5.24
TABLE 5.24

SIGNIFICANCE OF DIFFERENCE BETWEEN THE MEAN SCORES OF I.Q. OF STUDENTS OF URBAN AND RURAL AREA

<table>
<thead>
<tr>
<th>Area</th>
<th>N</th>
<th>M</th>
<th>S.D</th>
<th>SED</th>
<th>t-value</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban</td>
<td>2094</td>
<td>34.51</td>
<td>5.80</td>
<td>0.17</td>
<td>1.11**</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Rural</td>
<td>2320</td>
<td>34.70</td>
<td>5.50</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* t value significant at 0.01 level = 2.58
** t value significant at 0.05 level = 1.96

From table 5.24, it is observed that the t-value of the mean scores of I.Q. of students of urban and rural area is not significant.

5.7.5 Percentile Rank

The percentile rank is the statistics used most frequently in reporting the results of the standardized tests. It is probably the best type for general use in test interpretation. A percentile is any one of the ninety-nine points, which divide a frequency distribution into one hundred groups at equal size. “A Percentile Rank is a person’s relative position within a specified group.”

There is no significant difference in intelligence score of boys and girls as well as students belonging to urban and rural area. So there is no need to establish percentile norms separately for boys and girls as well as urban and rural area student. At the same time there is
significant difference in intelligence score of different grades and age groups. So separate percentile norms are establish for different grades and age groups.

For the present work, percentile ranks have been calculated by using the following formula.

\[
PR = \left[ Fc + \frac{(X-L)}{fi} \times \frac{100}{N} \right]
\]

Fc = Cumulative frequency below the class interval in which given score falls.

X = Score whose PR is to be found.

L = Lower limit of the class interval in which score falls.

fi = Frequency of the class interval in which score falls.

i = Class interval

N = Total number of students.

The PR for the raw scores on Intelligence test for upper primary school students of different age groups is shown in Table 5.25
<table>
<thead>
<tr>
<th>Raw scores</th>
<th>Age group in years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>9.6-10.5</td>
</tr>
<tr>
<td>1</td>
<td>0.14</td>
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<td>0.42</td>
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<td>13.74</td>
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<td>16</td>
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</tr>
<tr>
<td>17</td>
<td>18.60</td>
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<tr>
<td>18</td>
<td>21.03</td>
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<td>30</td>
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<td>31</td>
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<td>72.38</td>
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<td>---</td>
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<td>37</td>
<td>76.03</td>
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<tr>
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<td>89.35</td>
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<td>42</td>
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<td>43</td>
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<td>54</td>
<td>97.72</td>
</tr>
<tr>
<td>55</td>
<td>98.07</td>
</tr>
<tr>
<td>56</td>
<td>98.42</td>
</tr>
</tbody>
</table>
5.7.6 The Deviation IQs for Different Age Groups

The Binet's intelligence test is well known that measures mental ability, which express scores on an age scales. The intelligence quotient (IQ) also known as ratio- IQs is developed as an index of the rate of intellectual development and is defined as the ratio of the child's mental age to his chronological age.
i.e. I.Q. = \( \frac{M.A}{C.A} \times 100 \)

Where,

M.A = Mental age determined through an intelligence test.
C.A = Chronological age of the testee at the time of testing, and multiplication by a factor of 100 to eliminate decimal places.

It can be seen from formula that a child whose intellectual development is average for his age i.e. whose mental age equals his chronological age; he/she will obtain an I.Q. of 100. A child's mental development is more rapid than average will obtain scores over 100, and whose development is slower than average will obtain IQ.'s below 100. An I.Q. computed in this manner i.e. the ratio of mental age to chronological age, is known as a ratio I.Q. Because of the problems associated with non-equivalent standard deviation and because of the fact that intellectual growth does not increase linearly with increasing age, the ratio I.Q. has no longer been used in the major intelligence tests now. Instead, standard scores based on a representative sample of the population of each age level are used. These sores are known as deviation IQs.
Wechsler (1958) is recognized as a pioneer thinker of deviation IQ. According to him, "Deviation IQ. is a person's intelligence at any given time and is defined by his relative standing among his groups."

According to Brown (1970) "Deviation IQ. has a mean of 100 and a standard deviation of 15 at each age level."

In order to retain the qualities of IQ.'s, deviation IQ. is used and hence for the present test, the investigator has decided to compute the deviation IQ.'s for each age group within the norm sample. One big advantage of a deviation IQ. is that it has a common standard deviation for all the ages covered by the test on which it is determined.

The authors of the "1960 revision of S.B." decided to adopt the deviation IQ. so that the S.D. would be the same from age to age. The formula is:

\[ \text{Deviation IQ.} = 15Z + 100 \]

Where,

\[ Z = \frac{X - M}{\sigma} \]

\( X \) = Raw score
\( M \) = Mean score of the test
\( \sigma \) = Standard deviation of the test

This deviation IQ’s had a mean of 100 and a standard deviation of 15. The increasing use of deviation IQ’s is important to remember that deviation IQ's from different tests are comparable only when they
employ the same or closely similar values for the S.D. This value should always be reported in the manual and carefully noted by the test user. For the present test, the deviations IQ’s are computed with a mean of 100 and S.D. of 15. The following Table 5.26 shows the raw scores and their equivalent deviation IQ’s for different age groups.

**TABLE 5.26**

**DEVIATION IQ’S FOR DIFFERENT AGE GROUPS**

<table>
<thead>
<tr>
<th>Raw scores</th>
<th>Age group in years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>9.6-10.5</td>
</tr>
<tr>
<td>1</td>
<td>79.30</td>
</tr>
<tr>
<td>2</td>
<td>80.05</td>
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<tr>
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<tr>
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<td>102.70</td>
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<td>33</td>
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<tr>
<td>53</td>
<td>118.60</td>
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<td>67</td>
<td>129.25</td>
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<td>68</td>
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<tr>
<td>69</td>
<td>130.75</td>
</tr>
<tr>
<td>70</td>
<td>131.50</td>
</tr>
</tbody>
</table>
5.8 CLASSIFICATION OF INTELLIGENCE OF THE STUDENTS

The classification of intelligence is an effort similar to distinguishing colors of a rainbow spectrum. The earlier classification of intelligence were very rough ones. According to the various patterns of behavior in medical terms, they classify them as idiots, imbeciles, morons etc. Terman classified individuals attaining IQ’s below 70 are designated as mentally defective, those between 80 and 90 as dull normal, those between 90 and 100 as average, and so on. In the present test the classification of intelligence based on this above mentioned statistical concept of intelligence as proposed by Wechsler was considered. The classification proposed by Wechsler is that intelligence level will have a class interval covering of IQ’s falling at measured distance from the mean, these distance being expressed as multiples of standard deviation. Thus mentally defective one is a person whose IQ falls. Table 5.27 shows the classification of IQ’s of the present test.
TABLE 5.27
CLASSIFICATION OF IQ’S OF INTELLIGENCE
OF THE STUDENTS

<table>
<thead>
<tr>
<th>Classification</th>
<th>I.Q limit</th>
<th>% Included</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extra-ordinary</td>
<td>140&amp;above</td>
<td>0.113%</td>
</tr>
<tr>
<td>Very superior</td>
<td>130-139</td>
<td>1.721%</td>
</tr>
<tr>
<td>Superior</td>
<td>120-129</td>
<td>6.366%</td>
</tr>
<tr>
<td>Higher average</td>
<td>110-119</td>
<td>11.577%</td>
</tr>
<tr>
<td>Normal or Average</td>
<td>90-109</td>
<td>51.563%</td>
</tr>
<tr>
<td>Low average</td>
<td>80-89</td>
<td>17.988%</td>
</tr>
<tr>
<td>Very low average</td>
<td>70-79</td>
<td>10.127%</td>
</tr>
<tr>
<td>Backward</td>
<td>69 &amp; below</td>
<td>0.657%</td>
</tr>
</tbody>
</table>

5.9 RELIABILITY OF INTELLIGENCE TEST

Two important constructs in measurement are reliability and validity. The constructs of any psychological tool can never be considered as complete, unless it is tested for its reliability and validity. Reliability and validity provide the stability and trustworthiness. A test score is called reliable when it provides reasons for believing the scores to be stable and trustworthy. Stability and trustworthiness depends upon the degree to which the score is an index of true ability and is free of chance error.

According to Rammers and Gage(1967) “Reliability is the consistency with which a test yields same result in measurement whatever it doe measure.”
Anastasi says (1961) Reliability refers to the consistency of scores obtained by the same persons when reexamined with the same test on different occasion, or with different set of equivalent items, or under other examining conditions.

Reliability refers to the extent to the which a measuring device is consistent in measuring whatever it measured.

These qualities are essentially important in educational research, because most of the measurement attempted in this area are obtained indirectly. It is essential therefore for the investigator to assess the reliability and validity of intelligence test. So that the test will measure precisely and dependably what it is intended to measure.

There are different method for determining reliability of the test like…

(i) Test-Retest Method
(ii) Split-Half Method
(iii) Rational Equivalence Method

But for determining the reliability of the intelligence test, the investigator find out reliability by the following method.

(i) Test-Retest Method
(ii) Split-Half Method

5.9.1 Reliability by Test-Retest Method

200 upper primary students were selected for calculating the coefficient of stability or reliability by the test-retest method. The
intelligence test was administered to the same group of pupils again at an interval of one month and five days. The reliability of I.Q. test was calculated by the product moment method. The data of I.Q. test scores is presented in the following scatter diagram.

The formula for calculating correlation is as follows

\[ r = \frac{\sum x'y' - c_{x}c_{y}}{N \sigma_{x} \sigma_{y}} \]
TABLE 5.28
SCATTER DIAGRAM OF SCORES ON INTELLIGENCE TEST OF THE TWO ADMINISTRATION AT DIFFERENT INTERVALS

<table>
<thead>
<tr>
<th>CLASS INTERVAL (I.Q. Scores)</th>
<th>Retest Scores (After 1 month 5 days)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0-9</td>
</tr>
<tr>
<td>70-79</td>
<td></td>
</tr>
<tr>
<td>60-69</td>
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<td>50-59</td>
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<td>10-19</td>
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<tr>
<td>00-09</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>12</td>
</tr>
</tbody>
</table>

Product moment coefficient of correlation $\gamma = 0.88$, $SE_r = \pm 0.015$

The test - retest reliability is 0.88, which shows that the test-retest reliability of the test is very high.
5.9.2 Reliability by Split-Half Method

A sample of 200 upper primary school students were selected at random for determining the reliability value of the intelligence test. In the split-half method, the test was divided into two equivalent halves. The scores of odd items and even items were taken separately. The correlation coefficient was found between the odd and even no. of items. From the reliability coefficient of half test, the reliability coefficient of the whole test was estimated by using the Spearman-Brown prophecy formula which is given below:

\[ Y = \frac{Y^{1/2} \pi}{1 + Y^{1/2} \pi} \]

Where, \( Y = \) Reliability coefficient of whole test

\[ Y^{1/2} \pi = \) Reliability coefficient of half test

This formula assumes that the variances of the two halves are equal. If they are not, the estimated reliability of the whole test will be greater than that obtained by other methods of internal consistency. A split half reliability estimate is interpreted in a manner similar to the interpretation of a coefficient of equivalence. However, as the two forms are, in essence, administered simultaneously, only fluctuations that are of such a short term will be very less that influence reliability. The following table 5.29 shows the I.Q. scores of odd and even no. of items.
### TABLE 5.29

**SCATTER DIAGRAM OF ODD AND EVEN NO. OF ITEMS ON INTELLIGENCE TEST**

<table>
<thead>
<tr>
<th>CLASS INTERVAL (I.Q. Scores)</th>
<th>Scores on Even items</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0-4</td>
</tr>
<tr>
<td>35-39</td>
<td></td>
</tr>
<tr>
<td>30-34</td>
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<td>25-29</td>
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<td>20-24</td>
<td>2</td>
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<td>15-19</td>
<td>8</td>
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<td>10-14</td>
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<tr>
<td>5-9</td>
<td>10</td>
</tr>
<tr>
<td>0-4</td>
<td>12</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>22</strong></td>
</tr>
</tbody>
</table>

The split half reliability coefficient $\frac{1}{2} \overline{r} = 0.93$

Estimate of the reliability of the whole test. $Y = 0.96$ $SEr = \pm 0.005$

In S-B formula, scores of the odd items and the even items were found out and arranged into scatter-gram. This is called reliability of half test. From that reliability of whole test was found out. The split half reliability coefficient of this test is 0.93, but estimate of the reliability of the whole test is 0.96. which shows that the reliability of the test is very high.
5.9.3 Comprehensive view of reliability of whole test

Comprehensive pictures of the obtained reliability coefficient by test-retest method and split-half method is given in table 5.30

**TABLE 5.30**

**COMPREHENSIVE VIEW OF THE OBTAINED RELIABILITY COEFFICIENT OF PRESENT TEST**

<table>
<thead>
<tr>
<th>Sr.No</th>
<th>Type of Reliability</th>
<th>SEr.</th>
<th>Reliability Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Test-Retest</td>
<td>±0.015</td>
<td>0.88 ± 0.015</td>
</tr>
<tr>
<td>2</td>
<td>Split Half(S.B.Formula)</td>
<td>±0.005</td>
<td>0.96 ± 0.005</td>
</tr>
</tbody>
</table>

The reliability coefficient calculated by different methods of reliability ranges from 0.88 to 0.96. This shows that this test has comparatively good and satisfactory reliability. Thus the test is reliable.

5.10 VALIDITY OF THE TEST

Validity is the most important single attribute of the test, nothing can be gained by testing unless the test has its validity for use.

(i) **Concept of Validity:**

Validity of the test is based on

(a) What the test measures? And

(b) How well the test assesses?
Like consistency, validity is a genetic term given to a class of closely related ideas, concepts and procedures. Validity can thus be defined at various levels and ways. Validity defined by different psychologists has been stated as follow:

**Lyman (1963)** “Validity refers to the ability of the test to do the job we want to do.”

**Stodola (1968)** “validity refers to the effectiveness of a test in achieving specified purpose.”

**According to freeman (1962)** “An index of validity shows the degree to which a test measures what it purport to measure, when compared with accepted criteria.”

Above definition reflect the idea that the test is valid, if it fulfills the purpose for which it is designed. i.e. the intelligence test should assess only the intelligence and nothing else.

The validity of physical instrument can be obtained very easily and accurately. But it is very difficult to get independent standards in mental measurement. The validity of psychological test can never be estimated very accurately. The validity of psychological test is a relative term. A test is valid for particular purpose or in a particular situation is generally valid. Validation is an unending process. The validity of a test is generally found out by finding the correlation between the test and some independent criterion.
(ii) Method for Determining Validity:

Different psychologists have shown the different type of validity which are stated as below:

**Garrett states(1981):**

(a) Content validity (b) Face validity (c) Experimental validity
(d) Factorial validity

**Cronbach notes(1964):**

(a) Predictive Validity (b) Concurrent Validity (c) Content Validity (d) Empirical Validity (e) Construct Validity

**Lyman(1963):**

(a) Face Validity (b) Content Validity (c) Empirical Validity
(d) Construct Validity

Main purpose of the present study was to construct a valid and reliable measure of intelligence.

The “Intelligence Test”, thus developed implies the need to obtain satisfactory criteria against which one can validate the test.

Whether it is a test of any kind, it is always, imperative to decide a good and reliable criterion before the work of constructing the test item is undertaken. If a test constructor selects a reliable criterion right from the beginning and selects only those items which are found valid, he can be confident about the validity of his test. Therefore, due care has been taken while constructing and selecting proper items for the test.
The method adopted for the validity of Intelligence Test were:

5.10.1 Congruent Validity

If the test scores are correlated with some previously standardized intelligence test, the correlation coefficient obtained represents the congruent validity of the test. The congruent validity has been established by validating the present test against intelligence test which was constructed and standardized by J. Z. Patel for primary school students which is non verbal test and it is meant for the same standards or age group. Both the test were administered to 200 students for different grades. Correlation of the scores between the present test with J. Z. Patel intelligence test were calculated grade wise and presented in table 5.31,5.32 & 5.33.
**TABLE 5.31**

**CORRELATION OF THE I.Q. SCORES OF STUDENTS OF GRADE-V BETWEEN THE PRESENT INTELLIGENCE TEST AND J. Z PATEL INTELLIGENCE TEST**

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</table>

Coefficient of correlation \( r = 0.84 \)  \( SEr = \pm 0.018 \).

From Table 5.31, it can be observed that the coefficient of correlation is 0.84 which is high. So it can be concluded that the validation of the present test for grade-V against J.Z.Patel IQ test seems fairly high as coefficients of correlation is high.
**TABLE 5.32**  
CORRELATION OF THE I. Q. SCORES OF STUDENTS OF GRADE-VI BETWEEN THE PRESENT INTELLIGENCE TEST AND J. Z PATEL INTELLIGENCE TEST

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<td>65</td>
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</tbody>
</table>

Coefficient of correlation $\gamma = 0.87$, $SEr = \pm 0.030$

From Table 5.32, it can be observed that the coefficient of correlation is 0.87 which is high. So it can be concluded that the validation of the present test for grade-VI against J.Z.Patel IQ test seems fairly high as coefficients of correlation is high.
TABLE 5.33
CORRELATION OF THE I.Q. SCORES OF STUDENTS OF GRADE-VII BETWEEN THE PRESENT INTELLIGENCE TEST AND J. Z PATEL INTELLIGENCE TEST

<table>
<thead>
<tr>
<th>Class-interval (I.Q.Scores)</th>
<th>J. Z Patel Intelligence test Scores</th>
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<tbody>
<tr>
<td></td>
<td>0-9</td>
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<td>70-79</td>
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<tr>
<td>Total</td>
<td>4</td>
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</tbody>
</table>

Coefficient of correlation \( \gamma = 0.90 \) \( SEr = \pm 0.023 \)

From Table 5.33, it can be observed that the coefficient of correlation is 0.90 which is high. So it can be concluded that the validation of the present test for grade-VII against J.Z.Patel IQ test seems fairly high as coefficients of correlation is high.
5.10.2 Testing of validity from the marks obtained in first test

The IQs. of the students of grade V to VII on marks obtained in first test was computed and is represented in the scatter diagram presented in Table 5.34, 5.35 and 5.36 respectively.

**TABLE 5.34**

**SCATTER DIAGRAM BETWEEN THE IQ. SCORE OF STUDENTS OF GRADE-V ON THE PRESENT TEST AND MARKS OF FIRST TEST**

<table>
<thead>
<tr>
<th>Class Interval (I.Q. Scores)</th>
<th>Marks of first test</th>
<th>Total</th>
</tr>
</thead>
<tbody>
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<td>60-69</td>
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<td>Total</td>
<td>7</td>
<td>7</td>
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</tbody>
</table>

Coefficient of correlation $\gamma = 0.93$, $SEr = \pm 0.016$

From Table 5.34, it can be observed that the coefficient of correlation is 0.93 which is high. So it can be concluded that the validation of the present test against the marks of first test seems fairly high.
### TABLE 5.35

**SCATTER DIAGRAM BETWEEN THE I.Q. SCORE OF STUDENTS OF GRADE-VI ON THE PRESENT TEST AND MARKS OF FIRST TEST**

<table>
<thead>
<tr>
<th>Class interval (I.Q. Scores)</th>
<th>Marks of first test</th>
<th>Total</th>
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<td><strong>Total</strong></td>
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Coefficient of correlation = $\gamma = 0.91$, SEr = ±0.021

From Table 5.35, it can be observed that the coefficient of correlation is 0.91 which is high. So it can be concluded that the validation of the present test against the marks of first test seems fairly high.
TABLE 5.36

SCATTER DIAGRAM BETWEEN THE IQ. SCORE OF STUDENTS OF GRADE-VII ON THE PRESENT TEST AND MARKS OF FIRST TEST

<table>
<thead>
<tr>
<th>Class interval (I.Q. Scores)</th>
<th>Marks of first test</th>
<th>Total</th>
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<td>Total</td>
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</table>

Coefficient of correlation \( r = 0.93 \), \( SEr = \pm 0.016 \)

From Table 5.36, it can be observed that the coefficient of correlation is 0.93 which is high. So it can be concluded that the validation of the present test against the marks of first test seems fairly high.
5.11 CONCLUSION:

In this chapter development of the test, pre-pilot testing, pilot testing and final run out were described. At the same time norms were established. PRs. and Deviation IQs, reliability and validity of the present test were also discussed in this chapter. The value of reliability and validity were computed by different methods. The value of reliability coefficients vary from 0.85 to 0.96 which shows that the test is highly reliable. The correlation between the I.Q. scores with J.Z.Patel I.Q. test and marks of first test vary from 0.84 to 0.93 which shows that the values of validity were fairly high. Thus the present test is found satisfactory which are highly reliable and having fairly high validity. In the next chapter related studies are presented.
REFERENCES


