CHAPTER - 5

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5.1 DEPENDENT VARIABLES UNDERTAKEN FOR THE STUDY

Two measures of the dependent Variable - Cognitive growth and development - were undertaken in this study. They have been described as set A and set B.

Set A Cognitive Ability Tests (CogAT)

Grades I, II
- Classification
- Analogy
- Comprehension
- Following instructions
- Composite score of above 4 subtests ($Y_1$)

Grades III, IV
- Classification
- Analogy
- Comprehension
- Arithmetic Ability
  (a) Series (b) Equation building
- Composite score of above 4 subtests ($Y_1$)

Set B. Piagetian Conservation Tasks (PiCT)
- Length
- Sensation
- Number
- Area
- Mass
- Weight
- Volume
- Composite score of seven tasks ($Y_2$)
5.2 DATA COLLECTION ON THE DEPENDENT VARIABLES

5.2.1 Cognitive Ability Tests : Non-verbal (For Grades I-II)

a At the outset, the present investigator decided to construct two different types of cognitive ability tests for grades I and II and for grades III and IV separately, the first one being non-verbal (pictorial) and the other one, a verbal-type. To construct original tests for tribal pupils of grades I and II, she took Otis-Lennon test -form R Primary Level I and Primary Level II as a basis and selected four types of non-verbal subtests:

(a) Classification
(b) Analogy
(c) Comprehension
(d) Following Instructions

b To study the social environment of the tribal people, the present investigator visited the Tribal Research Institute at Gujarat Vidyapith, Ahmedabad and went through some books which threw light upon their mode of living, habitation, festivals, dress, etc. Also in order to have first hand experience, she went to stay with the tribal people in Panchmahal district for a few days and actually observed their mode of living as well as their daily routine. She had discussion with some elderly people of the village as well as the teaching staff of the primary school. The people were very co-operative, hospitable and they provided all the information she wanted to have, with full zeal. The information collected by these two ways was amply useful to her while coining the test-items. The stay at the village Zambua also helped her to establish rapport with pupils and the teaching staff and in carrying out pilot testing in the primary school of that village with an ease as she was no more an unknown person to most of the pupils. (Some pupils were coming from nearby villages also.)

It was predecided to have fifteen items in each subtest for the final run, thus total number being sixty in the test. So the present investigator coined more than one and a half number of items for each subtest than it was actually required. Instead
of giving these subtests as an open-end (that is, without distractors), to save time and labour both, she consulted four experts in psychological testing in addition to her supervisor and finalised three distractors for each item along with a correct answer, thus having four alternatives in each item.

(A) Pre-piloting of CogAT

Objectives:

1. To enable the investigator to make familiar with the content of a subtest, test-material and the procedures to be followed in administering the whole test

2. To check how far the oral instructions were satisfactory

3. To locate ‘bugs’ in the test items from the experience of the administration of sub-tests and performance of the subjects

4. To rearrange the test items within a subtest on the basis of arbitrary facility (difficulty) value - FV (percentage of passing the item)

5. To refine the test items in view of all the above and prepare each subtest for the pilot-testing

For a pre-pilot testing, only one class of grade I was administered the whole test in two different sessions and again, the class (N=39) was divided into two divisions so that the total number would not exceed twenty. As this type of experience was totally new to pupils, the assistance of four senior teachers was taken as proctors who were emphatically instructed not to say anything of their own to pupils and adhere strictly to instructions given orally by the investigator herself. As this was a new experience to her also, the supervisor was also present in all the testing sessions. His presence imparted courage and confidence to the investigator. It was observed from this experience that,
a test items in subtests 3 and 4 were bit difficult and required replacement by some easy items.

b it was necessary to explain the illustration by writing on the blackboard twice instead of only once.

c even in a practice item, after the pupils’ correct response, it was necessary to explain it again on the blackboard.

d after analysing the responses of pupils and the discussion with the head-master, it was found necessary to change some distractors as well as use some simple words so that the pupils could understand them properly.

e the most important observation was that some of the pupils of grade I were not able to follow instructions properly and also the mode of responding the item. So it was decided to provide a helper- a pupil of grade VI or VII - individually to each pupil; the helper would be totally persuaded emphatically not to make any change in the response given by the pupil and just put cross-mark (X) in the circle indicated by the testee. Again, there would be two to three teachers in the classroom who would supervise the testing procedure meticulously.

f it was also decided to have two dozen sharpened pencils with the administrator for each and every session, no time should, in any case, be wasted to sharpen the pencil during the administration-session, by any pupil. The proctor would go to the pupil as he would raise his hand for the help.

(B) Pilot Testing :

After taking into consideration all the above observations, modifications in some items, distractors, instructions ( in an illustration and a practice item ), over-all instruction and mode of administration were made. The pilot-study was carried out in Panchmahal’s district itself at two different tribal primary schools having grades I to VII: (a) Sahada primary school and (b) Telsar primary school, the care being taken that both schools being of mediocre type in the tribal area.
The prime objective of this try out was to carry out item-analysis which is the very basis for constructing a psychological test. This objective can be spelled out into the following sub objectives:

1. To compute FV and DI for each test item of all the four subtests
2. To select fifteen test items in each subtest on the bases of FV and DI
3. To arrange selected items for the final run as per FVs from easy to difficult
4. To finalise the booklet format and oral instructions to be imparted for the final run

Selection of the Sample: One class each of grades I and II in both the schools was administered all the four subtests in two different sessions. Here again, the pupils of grade I were subdivided into two divisions and help of pupils of grades VI and VII was taken to assist the pupils in writing their responses. Such help was not needed for pupils of grade II. All the pupils present in the class were included in testing. In the grade I, the total number was 67 drawn from both the schools while that in the grade II was 70.

Administration: Besides the present investigator, the help of two teachers was procured as proctors. As the class-rooms were small to accommodate all the pupils of the grade II, the long verandah was utilised. Two dozen sharpened pencils were kept ready. The illustration was fully discussed in both the grades twice, the practice test was also explained on the black-board for all the subtests. It was observed that though pupils were facing a novel situation, they were jovial and co-operated fully. They tried their best to follow the oral instructions imparted and one or two pupils raised some queries when they did not follow them properly. It was also observed that few pupils in each class did not follow what they had to do. Such cases were noted and the present investigator encircled their booklets on the front page—such cases were to be discarded while analysing the data for item-analysis. It was also noted that because of pre-pilot testing and changes/modifications made in the instruction as well as some test-items, there was no major difficulty encountered in the pilot-testing. Full time was given to each group to answer all the items of each sub-test. Of course, pupils whose answer sheets were encircled as mentioned earlier were not taken into consideration.
Scoring the Subtests : After finishing the work of administering the whole test to 137 pupils of grades I and II, the investigator prepared a page wise slip of correct answers and assessed the booklets with their help. For grade II, in subtest 3-Verbal comprehension - there was not one and only one correct answer. With the help of the supervisor, the present investigator ascertained which responses were correct and which were not. She, then, made a list of correct and incorrect responses for each item. Whenever she faced difficulty whether the response given by the testee should be considered correct or not, she referred such responses to the supervisor. For some responses, the supervisor consulted his colleagues. Over and above the cases that were discarded while testing was carried out, there were few cases which were to be deleted because either the responses were not complete in some subtests or the pupils did not co-operate fully and put cross-marks at two places (in grade II), few ones did not respond to all the items and left items in between without trying them. All such cases were discarded. The final sample, thus available for item analysis was 55 for grade I and 64 for grade II. The booklets of these pupils were arranged in a descending order, that is, one having the highest score was on the top, that having the lowest score at the bottom. It should be clarified here that all the correct answers of test-items in all the subtests for grades I and II were given a score of one and the incorrect answers a score of 0. Such items are known as dichotomous items which are different from multipoint items, as for example, those found in Wechsler Intelligence Scales.

(C) Item-Analysis:

The adequacy of a test, whatever its purpose may be, depends upon the care with which the items have been chosen. As Ebel remarks, "Item analysis indicates which items may be too easy or too difficult and which may fail for other reasons to discriminate clearly between the better and the poorer examinees." Items can be analysed qualitatively and quantitatively. For qualitative analysis one has to take content and form into consideration, whereas for quantitative analysis the statistical
properties are considered. Qualitative item analysis makes it possible to shorten the test and at the same time it increases its validity and reliability by discovering ambiguous items. It also provides an opportunity to check up the test constructor’s subjective judgement in selecting the items for composing the test.

There are various methods for quantitative item analysis. The one and only objective of constructing CogAT for grades I to IV in this study was to use them as a dependent variable in canonical analysis and not to standardise them. Hence the usual procedure of 27% method put forth by T. L. Kelley was used and as the number of pupils in the upper group and the lower group was below 100, the following formulas were used to find out Facility Value (FV) (formerly known as difficulty value) and Discrimination Index (DI).

(A) \[ FV = \frac{(RU + RL)}{2E} \times 100 \]

where

\[ FV = \text{Facility value} \]
\[ RU = \text{the number of the testees answering correctly in the upper group} \]
\[ RL = \text{the number of the testees answering correctly in the lower group} \]
\[ E = \text{the number of the testees in either upper or lower group (27% of the total sample)} \]

(B) \[ DI = \frac{(RU - RL)}{E} \]

where

\[ DI = \text{discrimination Index} \]
\[ RU = \text{the number of the testees answering correctly in the upper group} \]
\[ RL = \text{the number of the testees answering correctly in the lower group} \]
\[ E = \text{the number of the testees in either upper or lower group (27% of the total sample)} \]

Here the same CogAT was administered to pupils of grades I and II. Both were totally separate groups. If high and low groups by 27% method were selected from the total sample (N=119), it was certain that majority cases of high groups...
would have been from pupils of grade II and those of low groups, from pupils of grade I, thus false item analysis values might have obtained. Hence, pooled selection method was adopted. A.E. Harper (Jr.) observed, "that High and Low groups be determined separately for each of the different samples. Then the Highs of all those samples should be pooled into a High group, and the Lows of all the samples pooled into a single Low group. I learned this method from Dr. V.B. Davis' booklet and have found it works well in all situations". 

In this study, 15 cases (27% of the pupils of grade I) and 17 cases (27% of the pupils of grade II) formed high and low groups separately. Thus both groups consisted of 32 cases each by pooled selection. Both values FV and DI were computed by formulas and fifteen items were selected in all the four subtests having FVs from 15 to 90 and DIs from 0.20 to 0.60 (in subtests II and IV, some items having DI of 0.19 were to be included in the final form). Table 5.1 shows FVs and DIs of the selected fifteen test items for each subtest. The same values of all the items in each subtest have been indicated in Appendix C.
TABLE 5.1
FACILITY VALUE AND DISCRIMINATION INDEX OF SELECTED ITEMS IN CogAT (Non-verbal)
[ Grades I and II; N=119(55+64)]
RU=RL=E=32

<table>
<thead>
<tr>
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<tbody>
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<td>1</td>
<td>85.93 (9)</td>
<td>.21</td>
<td>87.50 (17)</td>
<td>.19</td>
<td>82.81 (17)</td>
<td>.31</td>
<td>87.50 (14)</td>
<td>.19</td>
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<td>.28</td>
<td>81.25 (5)</td>
<td>.25</td>
<td>75.00 (7)</td>
<td>.31</td>
<td>82.81 (13)</td>
<td>.21</td>
</tr>
<tr>
<td>3</td>
<td>71.87 (4)</td>
<td>.37</td>
<td>79.69 (9)</td>
<td>.28</td>
<td>68.75 (11)</td>
<td>.44</td>
<td>75.00 (1)</td>
<td>.37</td>
</tr>
<tr>
<td>4</td>
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<td>.44</td>
<td>71.87 (6)</td>
<td>.37</td>
<td>64.06 (4)</td>
<td>.47</td>
<td>71.87 (12)</td>
<td>.44</td>
</tr>
<tr>
<td>5</td>
<td>64.06 (29)</td>
<td>.47</td>
<td>68.75 (18)</td>
<td>.44</td>
<td>60.94 (8)</td>
<td>.35</td>
<td>64.06 (5)</td>
<td>.41</td>
</tr>
<tr>
<td>6</td>
<td>57.81 (8)</td>
<td>.53</td>
<td>60.94 (2)</td>
<td>.47</td>
<td>56.25 (14)</td>
<td>.31</td>
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<tr>
<td>7</td>
<td>56.25 (5)</td>
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<td>50.00 (3)</td>
<td>.37</td>
<td>56.25 (7)</td>
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<tr>
<td>8</td>
<td>50.00 (16)</td>
<td>.35</td>
<td>48.53 (23)</td>
<td>.53</td>
<td>46.87 (1)</td>
<td>.25</td>
<td>50.00 (15)</td>
<td>.44</td>
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<tr>
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<td>.41</td>
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<tr>
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<tr>
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<td>.25</td>
<td>29.69 (4)</td>
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<td>.19</td>
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<tr>
<td>13</td>
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<td>28.12 (24)</td>
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<td>25.00 (25)</td>
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<td>23.44 (9)</td>
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<td>15</td>
<td>18.75 (20)</td>
<td>.25</td>
<td>15.62 (8)</td>
<td>.31</td>
<td>18.75 (23)</td>
<td>.19</td>
<td>17.19 (26)</td>
<td>.28</td>
</tr>
</tbody>
</table>

Figures in parentheses indicate the original serial numbers of the items.
The booklets for the final run were printed in such a way that each subtest would start on a new page. The items for the illustration and the practice test were not printed Instructions, also, were given orally The testee has to respond his answer by just putting cross-mark (X) in an appropriate circle. All these precautions were necessary as these tribal pupils had no prior experience of such a type of testing. The present investigator gave considerable individual attention to the children to make sure that directions (instructions) were followed, see that pages were turned properly in the test booklets and supervise other procedural details by providing individual assistance (in grade I; in grade II, only where such need arose) to each child with the help of a pupil from grade VI or VII and also by having two to three proctors in the class-room. The only aim behind such meticulous care was to get the best response from the testee himself without anybody's direct help of any type.

Time-limit for Each Subtest:

Before running the final run, it was quite essential to fix the time-limit for each subtest. In grade I, each item was to be read out and testees were given about 15 seconds for responding each item. But for pupils of grade II, more than enough time was to be allowed as these subtests were purely power tests and again, these pupils were from tribal area. The only reason to fix the time-limit for each sub-test was to see that two or three dull pupils in a classroom did not waste time unnecessarily for the whole class. Various psychologists like Cronbach, Bean, Ross, etc. have advanced different viewpoints for fixation of time-limit for such tests. For the fixation of time-limit, Nunnally opines.

That where the test is not intended to measure speed, the subject should be given a comfortable timelimit. A few students will feel that they do not have an adequate amount of time even if they work an hour after the rest of the students have left. Some time-limit is necessary simply as a convenience for the instructor, but most of the students should be able to complete the test without feeling pressured by time-limit.
The present test being purely a power test, it was decided to fix the time-limit in such a way that 90 percent of the pupils could consider all the items of a test. The whole test was administered in a primary school of Jambua to pupils of grade II. The testees were asked to raise their hands as soon as they finished the test. The stop-watch was started when they were asked to begin each subtest and was stopped when only two to three pupils ($N<40$) were preoccupied in finishing the subtest. Thus time-limit was fixed in full minutes (more than 30 seconds were taken as one minute) for each subtest. Thus time-limit fixed for subtests I, II, III, and IV was 8, 12, 16, and 18 minutes respectively.

Thus, the CogAT for grades I and II was ready for the final run. The illustration, the booklet, the time-limit were all fixed up for administering these tests to the representative sample of the tribal areas of Gujarat State for the final run.

(F) Illustration, Practice Test and Instructions

After entering the classroom which has been pre-rearranged by the class teacher having enough space between two pupils, each pupil having a slate (or a desk, if it is provided in the school) and a sharpened pencil (school bags being put aside), say "Namaste" to the pupils of the classroom. Check (i) the seating arrangement is in order (ii) each pupil has a pencil and a slate (iii) the blackboard is neat and clean (iv) chalk-sticks and a duster are there, (v) 2-3 proctors are in the classroom (vi) in the grade I, with each pupil, there is a helper from grades VI and VII, already instructed not to do anything but make cross-mark at the place indicated by the testee. Now address the pupils.

"Friends, do you like to see pictures and diagrams? Very good. Here you will be shown pictures and diagrams and explained their relevance. Then you have to answer by putting cross at proper places as per the instruction to be given to you.

Remember, this is not your examination. So, there is no question of passing or failing. You will like and enjoy this work. Is it not?"

Now, distribute the test booklet to each pupil and check that preliminary data have been filled in as per the instruction. Here, two proctors will look after the procedure to be followed properly. Then say,
There are four subtests in all. We will first complete two and then have a break. After that we will reassemble and complete the 3rd and 4th ones. Have you understood? Let us understand what we are supposed to do.

Subtest I - Classification: Here in all questions, five pictures are given. There is some similarity between characteristics of four whereas one is different from the others. You are required to find out the odd one and put a cross in the circle below the picture. Let us have an example to understand this.

Are these not pictures of five animals? Which is the odd one out of these five? OK, think it over. Who will answer this? Raise your figures (Ask one or two). Let us understand the similarity. Cow, Buffalo, Cat and Goat are of feminine type. Is it not? So, all of them, give milk. Does horse give milk? Horse is of masculine type. So horse is different from the other four. Hence, put a cross in the circle below Horse. Have all of you understood?

Now let us have a practice test.

Practice test:
Now, see the five pictures carefully and find out which one is the odd one and put a cross in the circle under it. Give them enough time. Have all of you marked the answer? Ask x and y about their answer. If correct, they are given kudos. If one is wrong, the other one is asked which is correct. See, except brush, all the other four are useful for writing. So brush is the correct answer. Those who have done correctly, raise your hands. Excellent. Those who have not done correctly, put a horizontal line on your answer and then put a cross in the circle under brush.

So, have all of you understood? If you have any doubt, raise your hands. Now, I will read question by question. Mark the answers properly (Observe the eye movements & other movements carefully to test their acceptability.)

Start the stop watch. After five minutes, say, "Hurry up now, only three minutes are left for you." After full eight minutes, say "Please stop writing, put down your pencils. Time is over."

Time - limit 8 minutes

Subtest II - Analogy: In this test, on the left hand side there are four squares having three pictures. The top two pictures have a particular relationship. The third picture has a similar relationship with one of the four pictures given on the right hand side. Find out the correct match and put cross in the square below it. Let us understand it by an example.

Example:

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Left

<table>
<thead>
<tr>
<th>☐</th>
<th>☐</th>
<th>☐</th>
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</thead>
</table>
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Right

<table>
<thead>
<tr>
<th>☐</th>
<th>☐</th>
<th>☐</th>
<th>☐</th>
</tr>
</thead>
</table>
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See, in the first square there is a coat which is lacking something. What is it missing? See, it does not have buttons. Buttons have been shown on the adjacent picture. Is it not?

Now you see the picture below. It is a door. What is missing in it? Is it not a bolt? Now you see the four pictures on the right hand side. Bolt is one of them. Since it is the correct answer, put a cross in the circle below this. You need not draw the picture in the vacant square. Have all of you understood? Let us have a practice test now.

Practice test:

Left

<table>
<thead>
<tr>
<th><img src="image1.png" alt="Table" /></th>
<th><img src="image2.png" alt="Chair" /></th>
</tr>
</thead>
</table>

Right

<table>
<thead>
<tr>
<th><img src="image3.png" alt="Ink Bottle" /></th>
<th><img src="image4.png" alt="Pen" /></th>
<th><img src="image5.png" alt="Book" /></th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image6.png" alt="Blank" /></td>
<td><img src="image7.png" alt="Blank" /></td>
<td><img src="image8.png" alt="Blank" /></td>
</tr>
</tbody>
</table>

So we have a table and a chair in the top two squares. In the third one, an ink bottle is there. You have to find out the object having similar relationship with the ink bottle as the table has with the chair. Find out the matching one from the four pictures on the right hand side and put a cross in the circle below the picture you have found out as the matching one.

Give sometime. Have all of you completed it? Now, tell me who will answer? Raise your hands. Ask one about the answer. If he tells correctly, he is given kudos. (If not, another pupil is asked until one gets correct answer.)

You are right, you need ink in the pen for writing as you need the chair with the table for sitting and writing. Those who have done correctly, raise your hands. Those who have got wrong answer, correct them properly by putting two slashes on the wrong answer and a cross in the circle below the fountain pen.

So, have all of you understood? If not, get your doubt clarified. Now, I will read question by question. Mark the answers properly.
After nine minutes, say, “Hurry up now, you have only three minutes more.”

After full twelve minutes, say, “Please stop writing; put down your pencils. Time is over. Don’t leave the room until you are told to do so. Be at your seat.” Under the supervision of the investigator (tester), the proctors would collect all the booklets, would count them and then only, the testees would be allowed to leave the room. Before it, the tester would thank the testees for their co-operation.

Time-limit: 12 minutes

In the second session, subtests III and IV are to be administered.

Subtest III - Verbal Comprehension: Friends, you have given two earlier tests very nicely and meticulously. Did all of you enjoy them? Now, let us complete the remaining two sub-tests.

(All will be given the booklets and will fill up the details required).

In this subtest, there are four pictures in each question. There are minor differences among the pictures. There is a statement about the pictures. You have to listen to the statement and understand it. Then you have to find out the picture which matches the statement and put a cross in the circle below this picture.

Now let us understand it by an illustration.

Illustration: Put a cross below the picture in which there is a ball on the table.
(Pictures to be drawn on the blackboard or the roll-up board with figures already drawn may be used.)

In all the four pictures, both the ball and the table are there. But which is the picture having ball on the table? Look at all four pictures carefully. See in the second picture, there is a ball on the table. Is it not?
Hence, let us put a cross in the circle below this picture. Is it all right?

Have all of you understood properly? Now let us have a practice test.

Practice test:

Put a cross below the picture in which one gets light through electricity.
(Pictures to be drawn on the blackboard)

Give them some time. Have all of you marked the answers? Hurry up.

OK, who will tell the answer? Raise your hands. (Ask any one of them; if reply is wrong, then ask another one.) Excellent. In the third picture there is an electric bulb which gives light through electricity. Hence, this is the correct answer. How many of you have got correct answer? Raise your hands. Those of you who have got wrong answers, correct them by putting two slashes on the wrong answer and a cross below the picture of the electric bulb.

Have all of you understood the way to answer the test?

Now, I will read question by question. You please understand properly and then reply. Before starting the test, write down your name, class and school name in the front. Do not hurry up in putting crosses.

Time limit: 16 minutes
Subtest IV - Following Directions: (Let all of them fill up the details on the booklets given to them)

In this test also each question has four pictures. Listen very carefully to whatever I tell. Find out the picture which corresponds to my statement and put a cross in the circle below it.

Let us have an example to understand this.

Example: Put a cross below the picture which has a triangle inside a circle and number 1 inside the triangle. (Pictures to be drawn on the blackboard.)

```
1

```

OK, Look at all the four pictures very carefully and find out the one in conformity with the statement given. Take your own time and then put a cross in the circle below it. (Explain it on the blackboard.)

You see, all pictures have number 1, the circle, and the triangle. The pictures (II) and (III) have triangle inside the circle. Out of these, picture II has number 1 inside the triangle. Is it not correct?

So, put a cross in the circle below picture (II). Have all of you understood?

Raise your hands. Excellent.

Now let us have a practice test.

Practice test

Put a cross below that picture which has (+) in first circle and (-) in second (Pictures to be drawn on the blackboard)

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129
Now, look at all the four pictures very carefully. Find out the picture conforming to the statement given and put a cross below that. Take your own time. Have all of you done it? Who will answer? Raise your hands. Ask any one of them at random. Repeat it until the correct answer comes out. Very good, the third picture is the correct answer. How many of you have done it correctly? Those of you have not done correctly, get it corrected (Explain it on the blackboard.)

Have all of you understood how to go ahead? If any doubt, please get it clarified.

Now I will read out each question. Listen very carefully and put cross below the correct answer. Do it very carefully.

Time-limit 18 minutes

The test-items of all the four sub-tests are presented in Appendix D.

5.2.2 COGNITIVE ABILITY TESTS: VERBAL (FOR GRADES III & IV)

To construct the test for grades III and IV, the present investigator studied Lorge-Thorndike test of various levels and selected verbal tests which would be more or less congruent to those framed for grades I and II. Only the last one, that is, Numerical ability was different and it consisted of two parts:

(a) Number Series and (b) Equation Building

Thus the cognitive ability tests for tribal pupils of grades III and IV comprised of four sub-tests, namely,

(a) Verbal Classification
(b) Verbal Analogy
(c) Verbal Comprehension
(d) Numerical Ability - (a) Number Series and (b) Equation Building

Here also, thirty items were coined in the first two sub-tests. In sub-test (c), there were 25 items. In sub-test (d), there were two sub-parts; (a) number series and (b) equation building. For each sub-part ten items were coined for the pre-pilot study. One more point was to be noted. In sub-test (c) - Verbal Comprehension -
items were open-ended, that is, no alternatives were provided as those in other sub-tests. Similarly, items in Numerical Ability sub-test (d) too, the distractors were not provided. Except these two modifications, all other characteristics were the same in the Cognitive Ability Test for grades I and II and grades III and IV. Of course, all the sub-tests here were of the verbal type.

(A) Pre-Piloting:

The objectives were the same as enumerated in the CogAT for grades I and II. It was administered to the whole class of grade III (N= 41) in the Zambua primary school of Panchmahals district. The following things were observed:

a. Test items in sub-test (iv) needed thorough explanation.

b. It was necessary to explain one example on the blackboard and to administer a practice question followed by explanation on the blackboard.

c. After a discussion with the teachers, it was felt necessary to replace some words by simple and locally used words.

d. It was decided to have at least two dozen sharpened pencils with the administrator for each and every session to provide the pupils needing them so that no time would be wasted.

e. It was decided to have at least two proctors to assist the investigator.

(B) Pilot Testing:

After taking into consideration all the above observations, the pilot study was carried out in the same two schools i.e. Sahada and Telsar of Panchmahals district. The objectives of this pilot testing were the same as indicated in CogAT for grades I and II.

Selection of the Sample: One class each of grades III and IV in both the schools was administered all the four subtests in two different sessions. All the pupils present in the class were included in testing. In grade III, the total number drawn from both the schools was 71 while that in the grade IV, it was 69.
Administration: The administration was in the same fashion as mentioned in CogAT for grades I and II with one exception—that pupils did their work of their own. No pupil from either grade VI or VII was required as a helper. Of course the assistance of two senior teachers were taken as proctors. There was also no need to divide the class pupils into two divisions. For administering the tests, the biggest room of the school, available, was used. If it was found not quite spacious, either the verandah or the shaded part of the playground was utilised. The pupils were instructed to keep with them a slate or a notebook and a sharpened pencil only. The arrangement was so made that neighboring pupil could not peep into the other's booklet. Of course, proctors as well as the investigator had to be very vigilant during the time of administering the tests.

Scoring of the Subtests: The investigator prepared a pagewise slip of correct answers and assessed the booklets herself. In the case of uncertainty in assessing responses, she took the guidance of the supervisor. There were few cases which were discarded because responses were not complete in some subtests or the pupils did not co-operate fully and put cross-marks at two places; or not responded all the items or left items in between without trying them. The final sample thus, available for item analysis was 65 for grade III and 64 for grade IV. All the correct answers of test items in all the four tests were given a score of one and the incorrect answers a score of 0. The booklets of the pupils were then arranged in a descending order, that is, one having the highest score was on the top, gradewise.

(C) Item Analysis:

It was done exactly in the same manner as was carried out in CogAT for grades I and II, earlier. That is, it was carried out by pooled system using 27% percent method. FVs and DIs were computed using the same formulas. The higher and lower groups consisted of 18 and 17 cases for grades III and IV respectively. Thus the total sample for item-analysis comprised of 35 cases in higher and lower groups each. Fifteen items in the first three subtests were selected having FVs from...
15 to 84 and DIs from 0.20 to 0.46. The Subtest IV- Quantitative Ability - had two parts (i) Series and (ii) Equation -building having 7 and 8 items respectively. The range of FVs and DIs was from 31 to 79 and 20 to 0.37 respectively. These values of all the test items used in the pilot testing have been shown in Appendix E, subtestwise while the same for selected items (15 in each subtest) has been presented in Table 5.2.

**TABLE 5.2**

**FACILITY VALUE AND DISCRIMINATION INDEX OF SELECTED ITEMS IN CogAT (Verbal)**

[Grades III and IV; N=129(65+64)]

<table>
<thead>
<tr>
<th>Sr No</th>
<th>Subtest-I</th>
<th>Subtest II</th>
<th>Subtest III</th>
<th>Subtest-IV</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DI</td>
<td>FV</td>
<td>DI</td>
<td>FV</td>
</tr>
<tr>
<td>1</td>
<td>82.86 (7)</td>
<td>.23</td>
<td>84.29 (17)</td>
<td>.20</td>
</tr>
<tr>
<td>2</td>
<td>77.14 (2)</td>
<td>.29</td>
<td>74.29 (5)</td>
<td>.34</td>
</tr>
<tr>
<td>3</td>
<td>71.43 (12)</td>
<td>.40</td>
<td>71.43 (6)</td>
<td>.29</td>
</tr>
<tr>
<td>4</td>
<td>68.57 (1)</td>
<td>.34</td>
<td>71.43 (6)</td>
<td>.29</td>
</tr>
<tr>
<td>5</td>
<td>60.00 (27)</td>
<td>.40</td>
<td>65.71 (18)</td>
<td>.46</td>
</tr>
<tr>
<td>6</td>
<td>55.71 (28)</td>
<td>.37</td>
<td>61.43 (2)</td>
<td>.37</td>
</tr>
<tr>
<td>7</td>
<td>51.43 (16)</td>
<td>.46</td>
<td>57.14 (21)</td>
<td>.40</td>
</tr>
<tr>
<td>8</td>
<td>50.00 (29)</td>
<td>.31</td>
<td>52.86 (23)</td>
<td>.31</td>
</tr>
<tr>
<td>9</td>
<td>45.71 (3)</td>
<td>.34</td>
<td>51.43 (1)</td>
<td>.34</td>
</tr>
<tr>
<td>10</td>
<td>40.00 (17)</td>
<td>.29</td>
<td>48.57 (20)</td>
<td>.40</td>
</tr>
<tr>
<td>11</td>
<td>32.86 (24)</td>
<td>.31</td>
<td>41.43 (10)</td>
<td>.26</td>
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<tr>
<td>12</td>
<td>25.71 (9)</td>
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<tr>
<td>14</td>
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<td>.23</td>
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<td>.26</td>
</tr>
<tr>
<td>15</td>
<td>15.71 (13)</td>
<td>.20</td>
<td>20.00 (8)</td>
<td>.23</td>
</tr>
</tbody>
</table>

Figures in the parentheses indicate the original serial numbers of the items.
(D) The Final Format of CogAT:

Here also, each subtest commenced from a new page. In the beginning, necessary instructions with an illustration and a practice test were already printed. The testee had to respond by drawing a line under the correct answer (alternative) in the booklet itself, in the first two subtests. In the third subtest, enough space was provided to write the answer for each test item. In the fourth subtest, the specific space was provided to write the response, either the number or the arithmetic symbol of plus/minus. The test items of all the four subtests have been appended as Appendix F. Its English version is appended as Appendix Q.

(E) Time-limit for Each Subtest:

After the booklets were printed, one class of grade III only of Zambua primary school was administered all the four subtests. For fixing up time-limit, the same procedure as was used in CogAT for grade II was followed here. The time limit fixed up for subtests 1, 2, 3 and 4 was 20, 20, 30 and 25 [(a) 15 (b) 10] minutes, respectively.

(F) Illustration, Practice test and Instructions:

Subtest I - Classification: In this sub-test in each question, there are four words. Out of them, three have a particular relationship where as one is having a different relationship with the other three. You read all the four words carefully, think over, find out the odd word and underline that word.

Let us understand by taking an example on the blackboard.

Example

Tortoise  Frog  Crocodile  Fish

All the four are names of animals: Is it not?
Have you seen tortoise living outside water?
Have you seen frog living outside water?
Have you seen crocodile living outside water?
So, all of them can live both in water and outside water

But have you seen fish alive for a long time outside water?
It will die if it stays for long. Is it not?

So, fish is the odd one since except this, all the other three animals can live both in and outside water

Hence, underline fish.

Have all of you understood?
If not, please raise your hand.

Now let us have a practice test.

Practice Test:

Spoon  Hammer  Saw  Screw driver

Now, find out the odd word and underline it
Pause for adequate time.

Let us see who will reply?

Ask X which word have you underlined? Continue asking others till one gets correct answer.

Very good, you are correct.

Now all of you whose answer is correct please raise hands.

Let us understand it properly

Out of the four, hammer, saw, screwdriver are the tools of the carpenter. He needs them in his work

Does the carpenter need spoon?
Is it not needed in the kitchen?

So, this word ‘spoon’ is different from all the other three words. Hence, it needs to be underlined. Those who have underlined a wrong word, please correct it by putting a cross on this and then underline the correct word.
OK, anybody needs now any clarification. If needed, please ask now. After the test starts, no body should ask anything. Now, let us start the test.

Subtest II - Analogy: This is the second test. In this, each question has a pair of words having particular relationship. After this pair, one word with sign of :: is given (:: show on the blackboard). Explore the relationship between the first pair. Find out the word out of the four words on the right hand side, which has similar relationship with the third word and then underline it.

OK, let us understand this with the help of an example. (on the blackboard)

(I) Coat Button :: Door : (a) Handle (b) Bolt (c) Lock (d) Hook

We need button to keep a coat closed. What is needed to close the door?

Read the four words carefully. Understand them and find out the correct matching word.

Which is the correct answer?
Can you close the door without bolt?
So, “bolt” is the correct answer.
Underline it. Have all of you understood?
Does anybody need any clarification?

OK, now let us have a practice test.

Practice test:

Mango tree Mango :: Neem tree :__________ (a) Reddish fruit of a banyan
(b) Neem-fruit (c) Lemon (d) Blossom of a mango tree

All of you underline the matching word.
Have all of you answered? Hurry up.
Do not write anything. Only underline the matching word.
Pause for adequate time.
Let us see who will reply?

You X, which word you have underlined? Continue asking till you get correct answer.

Very good, you are right.
Now, all of you whose answer is correct, please raise hands

OK, let us understand it properly. Mango tree gives us Mango fruit. What fruit do we get from Neem tree? Is it not neem?

So, neem is the correct answer.

Have all of you understood how to answer the test?

If not, now ask me any doubt you have.

OK. let us start the test now.

**Subtest III - Verbal Comprehension:** This test has some questions. There is adequate space for writing the answer below each question. You have to think and understand before writing the answer. Let us have an example.

Example:

What do we do with the help of eyes?

"You see through eyes or these are for seeing." It is the answer. Is it not?

Have you understood?

Raise your hands.

Now we will have a practice test.

Practice test:

With what organ does the elephant drink? Write down the answer.

You "X", what have you written?

(if the answer is correct)

Very good, the elephant drinks with the help of its trunk. Have you not seen the long trunk of the elephant?

(If the answer is wrong, ask "Y")

Those who have written wrong answer put a cross on it and write down the correct answer. Do not rub any answer if it is wrong. Put a cross only on the wrong answer. You need not do this for all questions. Do it only in cases where you feel that the answer is wrong.
OK, have all of you understood?

Does anybody need any clarification? Once the test starts, nobody should speak loudly or talk with others. If you have any difficulty, please raise your hand for assistance.

OK, start the test

Subtest IV- Numerical ability:

(I) Series: In some questions below, numbers have been written following particular rules. There are two dashes after this. You have to find out the particular rule governing the relationship of the numbers and then fill up the two blanks with appropriate numbers.

Now, let us understand with the help of an example.

Example.

1, 3, 5, 7, 9, _____, ____. (on black board)

Read the numbers and tell the rule governing them.

As we move forward, the numbers are increasing. Is it not?

What is the difference between consecutive numbers? Is it not 2?

So after 9 which number will come. Is it not 11?

After 11 which number will come? Is it not 13?

So 11 and 13 will fill up the two blanks. Have all of you understood the example?

Those who have not understood, please raise your hands. If necessary, it should be explained again.

Let us have a practice test now.

Practice test.

1, 2, 4, 7, 11, ____, _____

(Give adequate time).
Have all of you filled in the two blanks?
Raise your hands.
Some of you don’t understand properly. Let me explain.
You have 2 after 1, 4 after 2, 7 after 4, 11 after 7.
Now, think over, what is the order behind the above numbers?

\[ 1+1=2, \quad 2+2=4, \quad 4+3=7, \quad 7+4=11 \]

Is it not? Numbers being added are consecutive numbers in ascending order.

So now there should be increase of 5 and 6 respectively. Is it not? Hence,
11+5=16, will be the first number and 16+6 = 22 will be the second number
OK, those, who have written 16 and 22, please raise your hands.
Excellent.
Those who have written wrongly, correct the answer
Those who have not understood, raise your hands. (If necessary, explain them once again)

Now you see, you have 7 questions employing different rules. You identify the rule and then fill up the two blanks in each question with proper numbers.

Have you understood? If necessary, you may use notebook - pencil or slate-chalk-pen. Start now.

(II) Equation Building: Now let us see another set of questions in mathematics
To understand it, please see an example

Example:

\[ 8 \quad 8 \quad 16 \quad +/- \quad \text{answer} \]

Here three numbers are given followed by two arithmetical signs. There is a particular relationship between the three numbers, either plus or minus.
Now you think what is the relationship between the numbers?

\[ 8 + 8 = 16 \] Is it not?

So (+) is the correct answer.

Have all of you understood?

Now let us take a practice question.

Practice question:

\[ 5 \quad 3 \quad 15 \quad \times/- \quad \text{answer} : \]

Give adequate time. Now, who will answer? Ask X, Y until you get correct answer. Excellent, you are right. Explain on the blackboard.

\[ 5 \times 3 = 15 \] Is it not? So (×) is the correct answer.

Those who have written wrongly, put a cross on the answer and write the correct answer i.e. 5 × 3 = 15.

Have all of you understood?

Now start the rest of questions. If you need some rough work, you may use a notebook - a pencil or a slate - a chalk.

When the time is over, the same procedure as that in CogAT (non-verbal) is to be followed religiously.

5.2.3 Piagetian Conservation Tasks - The Concrete Stage (7-11 Years)

Bevli remarked:

The research in cognitive development appears to have yet to reach its peak and work stimulated by and addressing itself to Piagetian questions still dominates the field. Another recent development which may be mentioned is the cross-cultural Piagetian research like: how universal are the cognitive processes described by Piaget; to what extent is cognitive development determined by cultural variables; and which aspects of Piaget's theory have to be modified to take cultural variables into account, etc.
The above invaluable observation made in 1982 was still applicable in 1991 (when the present investigator was to be registered for her Ph.D. study). It was, therefore, resolved to have a second measure of a dependent variable by taking up Piagetian seven different conservation tasks. Of course, this study would be only the first step toward the application of concrete state (7-11 years) of Piaget's theory on GTC. It would open a new vista to more researchers in the same field.

Basically, Piagetian scales are ordinal in the sense that they presuppose a uniform sequence of development through successive stages. They are also content-referenced, in so far as they provide qualitative descriptions of what the child is actually able to do. Piagetian tasks focus on the long-term development of specific concepts or cognitive schemata rather than on broad traits. In this investigation, it was taken up as a second measure of the dependent variable.

The concrete stage is the third Piagetian stage of mental or intellectual development for the age groups 7 to 11. The various types of earlier thought activities, lacking logical operations, now attain a sort of mobile equilibrium. It is for the first time that the operations carried out by the pupils of this age group become reversible. During these ages, conservation is a very important scheme of thought. In fact, all rational knowledge depends upon the acquisition of this concept. It also undergoes sub-stages, namely, non-conservation, transitory and conservation. There is also a definite order in the acquisition of conservations.

Some conservation test items of Piaget were tried out while constructing 'The British Ability Scales' by (Late) Colin D. Elliot with the help of David J. Murray and Lea Peasron. Of course, conservation items were not finally included in the published British Ability Scales but were discussed fully in its manual in an Appendix.

Here, there were, in all, six different conservation items, namely, (a) Conservation of length I (b) Conservation of length II (c) Conservation of number I (d) Conservation of number II (e) Conservation of area and (f) Conservation of volume.
From the experiences of testing in the tribal areas of Gujarat State, it was resolved to have a pilot testing on those pupils of grades I to IV that were not to be included in collecting data for canonical analysis. The items were to be administered individually and again, materials, scoring system as well as procedures were already fixed, that is, were standardised. So, it was decided to take two boys and two girls from each grade from Sahada primary school, in the pilot run.

The following were the observations:

(I) In the first five items discussed in the Appendix of “British Ability Scales”, it was mentioned that in the very subpart of the procedure, “if the child makes an incorrect response, demonstrate until he agrees that are equal in the dimension (length, number, area, etc.)”. It was found necessary for tribal pupils of grades I to IV to consider the first subpart in each and every item, included in this study, as a practice test and no score for the same was to be allotted.

(II) “Conservation of length I and II” as well as “Conservation of Number I and II” were combined together and the maximum score one could secure would then be 3.

(III) The following items were added to it. (a) Serration (b) Mass (c) Weight.

(IV) “Part and whole” item was tried out in the pilot testing but the results were not so encouraging. Even the pupils of grades III and IV could not respond satisfactorily. Hence it was deleted.

(V) Thus, the total conservation items administered in the final run were seven.

(VI) Though there was no set order of administration for the different items, the present investigator followed one and only one pattern for uniformity.
Thus the present investigator took up the following concepts to test the conservation ability of pupils of grades I to IV of the tribal area:

(a) Conservation of Length
(b) Conservation of Seriation
(c) Conservation of Number
(d) Conservation of Area
(e) Conservation of Mass
(f) Conservation of Weight
(g) Conservation of Volume

Throughout the administration, the materials (sticks, cubes, flasks, plasticine, etc.) needed in different items were displayed as the testee would see them. Again, the wording of the questions were strictly adhered to. Here follows the description of the items:

(A) Conservation of Length

Material: Two sticks exactly 15 cm in length and of 5 mm. square cross section, coloured red and blue.

Scoring: Scoring 1 for correct response to ALL THREE questions in each subitem.

Procedure: NB: In all arrangements, sticks should be approximately 3 cm apart. Where a stick is laterally displayed, this displacement should also be approximately 3 cm.

Practice test 1

Place the two sticks in front of the child as shown:

(red)

(blue)

Say:
(a) Is the red stick (indicate) longer?
(b) Is the blue stick (indicate) longer?
(c) Are they the same length?

If the child makes an incorrect response, demonstrate until he agrees that they are the same length.

NB: Child should not touch the sticks.
No further teaching to be given.
Say Watch what I am doing.

(I) Rearrange sticks as shown:

- (red)
- (blue)

Say

(a) Is the red stick (indicate) longer?
(b) Is the blue stick (indicate) longer?
(c) Are they the same length?

Practice test 2

Place the three sticks in front of the child as shown:

- (red)
- (blue)
- (yellow)

Say

(a) Is one of them longer than the others?
(b) Is one of them shorter than the others?
(c) Are they all the same length?

If the child makes an incorrect response, demonstrate until he agrees that they are the same length.

NB: Child should not touch the sticks.

No further teaching to be given.

Say Watch what I am doing

(II) Rearrange sticks as shown:

- (blue)
- (yellow)
- (red)

Say

(a) Is one of them longer than the others?
(b) Is one of them shorter than the others?
(c) Are they all the same length?
(III) Rearrange sticks as shown

(blue)
(yellow)
(red)

Say

(a) Is one of them longer than the others?
(b) Is one of them shorter than the others?
(c) Are they all the same length?

Maximum score: 3

(B) Conservation of Seriation

Material: Five coloured wooden sticks. red - 3 cm., white - 4 cm., yellow - 5 cm., blue - 6 cm., green - 7 cm., all having 5 mm square cross-section

Scoring: One for correct answer, if the child arranges sticks in correct ascending order.

Note. The child should be given ample time to re-arrange stick to his satisfaction. When he finishes arrangement and see at the instructor, it indicates that the child has done his job.

Procedure: Place five sticks in front of the child as shown. In all arrangements, sticks should be approximately 3 cm. apart.

Ask the child to put sticks in ascending order of length.

Maximum score: 1
(C) Conservation of Number

Material: 8 blue cubes and 8 green cubes, all the same size, with approximately 2.5 cm sides.

Scoring: For each item, score 1 for correct response to all three questions in each subitem.

Procedure: Practice test: Place 8 blue blocks in a line in front of the child.

Put 8 green bricks on the table and say: You make a line like this. Help the child to make a matching line.

□ □ □ □ □ □ □ □ (blue)
□ □ □ □ □ □ □ □ (green)

Say:

(a) Are there more green blocks (indicate) than blue blocks (indicate)?
(b) Are there more blue blocks (indicate) than green blocks (indicate)?
(c) Are there the same number?

If the child gives an incorrect response, explain that there is the same number of blocks in each line and continue.

NB: Do not count the blocks.

No further coaching to be given.

Say: Watch what I am doing.

(I) Spread out the blocks as shown.

□ □ □ □ □ □ □ □ (blue)
□ □ □ □ □ □ □ □ (green)

Say:

(a) Are there more green blocks (indicate) than blue blocks (indicate)?
(b) Are there more blue blocks (indicate) than green blocks (indicate)?
(c) Are there the same number?
(II) Arrange the blocks as shown (dots indicate positioning)

□ □ □ □ □ □ □ □ (blue)
□ □ □ □ □ □ □ □ (green)

Say

(a) Are there more green blocks (indicate) than blue blocks (indicate)?
(b) Are there more blue blocks (indicate) than green blocks (indicate)?
(c) Are there the same number?

Practice test

Place 8 blue blocks in a line in front of the child.

Put 8 green blocks on the table and say "You make a line like this. Help child to make a matching line.

□ □ □ □ □ □ □ □ (blue)
□ □ □ □ □ □ □ □ (green)

Say

(a) Are there more green blocks (indicate) than blue blocks (indicate)?
(b) Are there more blue blocks (indicate) than green blocks (indicate)?
(c) Are there the same number?

If the child gives an incorrect response, explain that there is the same number of blocks in each line and continue.

NB: Do not count the blocks.

No further teaching is to be given.

Say "Watch what I am doing."

(III) Spread out the blocks as shown

□ □ □ □ □ □ □ □ (blue)
Remove the ringed pairs of blocks and say

(a) Are there more green blocks (indicate) than blue blocks (indicate)?
(b) Are there more blue blocks (indicate) than green blocks (indicate)?
(c) Are there the same number?

Maximum score: 3

(D) Conservation of Area

Material: Twelve green cubes, all the same size, with approximately 2.5 cm. sides.

Scoring: Score 1 for correct answers to all three questions in (I)

Procedure: Practice test

Arrange blocks as two 2x3 rectangles, as shown:

Say We are going to pretend that these are two fields of grass, where the farmer can send his cows to eat. The farmer could put his cows in this field (indicate) or this one (indicate).

(a) Now, does this field have more grass? (point to left-hand field).
(b) Does this field have more grass? (point to right-hand field).
(c) Do they both have the same amount of grass?

If the child gives incorrect response, explain until he is satisfied

NB: Do not count the cubes. If necessary, place one ‘field‘ on top of the other

(I) Rearrange rectangles as shown, saying Here are some other fields.

(a) Now does this field have more grass? (point to left-hand field)
(b) Does this field have more grass? (point to right-hand field)
(c) Do they both have the same amount of grass?

Maximum Score: 1
**Conservation of Mass**

**Material**: Two pieces of plasticine (red and yellow in colour) each about 2 cm x 2 cm x 6 cm in size.

**Scoring**: For each item, score 1 for correct response to all the three questions in each subitem.

**Procedure**:

**Practice test**: Make two balls of equal size from the two pieces of plasticine. Put them on the table.

![Red Plasticine Ball](image1)
![Yellow Plasticine Ball](image2)

Red

Yellow

Say: We are going to pretend that these are two balls of dough which your mother makes in the kitchen for making chapati.

(a) Now, does this ball have more dough? (point to the red ball)

(b) Does this ball have more dough? (point to the yellow ball)

(c) Have both the balls the same quantity?

If the child gives incorrect response, explain him until he is satisfied.

**NB** The child should not touch the ball.

Say: Watch what I am doing.

(I) Reshape the red ball as shown to the shape of a saucer

![Red Saucer](image3)

![Yellow Ball](image4)

(a) Now, does this saucer contain more dough? (point to the red saucer)

(b) Does this yellow ball have more dough? (point to the yellow ball)

(c) Have both the things the same quantity?
Say Watch what I am doing

(II) Reshape the red saucer into a stick

[Red saucer reshaped into a stick]

Red Yellow

(a) Now, does this red stick contain more dough? (point to the red stick)
(b) Does this yellow ball contain more dough? (point to the yellow ball)
(c) Have both the things the same quantity?

Maximum score: 2

(F) Conservation of Weight

Material: Two pieces of plasticine (red and yellow colour) each about 2 cm x 2cm x 6 cm in size.

Scoring: For each item, score 1 for correct response to all questions in each subitem.

Procedure:

Practice test. Place the two pieces of plasticine on the table and make two balls out of it.

[Red and yellow plasticine balls]

Say: We are going to play with these two balls. Take these balls one in each hand.

(a) Now, does the ball in your left hand weigh more? (indicate to his left hand)
(b) Does the ball in your right hand weigh more? (indicate to his right hand)
(c) Do both the balls weigh same?

If the child gives incorrect response, explain until he is satisfied.

Take back the balls from him.

Say Watch what I am doing.
(I) Make two small balls out of yellow ball as shown

Red    Yellow

Say: Hold the red ball in your left hand and two yellow balls in your right hand and feel them.

(a) Now, does the red ball weigh more? (indicate to his left hand)
(b) Do the two yellow balls weigh more? (indicate to his right hand).
(c) Do the balls in both of your hands weigh same?

Take back the balls from the pupil.

Say: Watch what I am doing.

(II) Make four small balls out of the big red ball as shown:

Red    Yellow

Say: Hold the red balls in your left hand and yellow balls in your right hand and feel them.

(a) Now, do the red balls weigh more? (indicate to his left hand)
(b) Do the two yellow balls weigh more? (indicate to his right hand).
(c) Do the balls in both of your hands weigh same?

Maximum score: 2

(G) Conservation of Volume

Material: Two conical flasks, one measuring cylinder, potassium permanganate, water

Scoring: Score 1 for correct response to all the three questions

Procedure:

Practice test: Place the two conical flasks on the table. Make coloured liquid out of potassium permanganate. Pour same amount of coloured liquid into both the flasks as shown:

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(a) Now, does the left flask contain more liquid? (indicate to the left side flask)
(b) Does the right flask contain more liquid? (indicate to the right side flask)
(c) Do both the flasks contain same volume of liquid?

If the child gives incorrect response, explain him until he is satisfied

Place the measuring cylinder in place of the right side flask

Say: Watch what I am doing.

Pour the liquid from the right side flask into the measuring cylinder as shown:

(a) Now, does the flask contain more liquid? (indicate to the flask)
(b) Does the measuring cylinder contain more liquid? (indicate to the measuring cylinder)
(c) Do both of them have same volume of liquid?

Maximum Score: 1
5.3 INDEPENDENT VARIABLES UNDERTAKEN FOR THE STUDY

As it was mentioned earlier in chapter IV, twelve independent variables were involved to study its effect on the cognitive growth and development of tribal pupils of grades I to IV in the state of Gujarat.

These independent (predictor) variables were:

1. **intelligence** ($X_1$):
   
   Draw-a-man test was utilised to estimate intelligence of pupils. For grades I and II, “Incomplete man” (Appendix G) was used while Pratima Phatak’s revised Draw-a-man test (Appendix H) was administered to pupils of grades III and IV.

2. **Visual Recall (immediate and delayed)** ($X_2$):
   
   Sudha Patel’s adapted visual recall test (Appendix I) taken from British Ability Scales had to be modified to tune it with cultural environment of tribal pupils. The modified test has been appended as Appendix J.

3. **number of siblings** ($X_3$)

4. **birth-order** ($X_4$)

5. **pupil’s inclination towards education** ($X_5$)

6. **pupil’s personality traits** ($X_6$)

7. **socio-economic status of parents** ($X_7$):
   
   To collect information of variables (3) to (7), Information Data Sheet for parents (IDSp) was prepared by the present investigator. IDSp has been shown as Appendix K. (English Version, Appendix-R)

8. **teacher’s qualifications** ($X_8$)

9. **teacher’s experience** ($X_9$)
(10) teacher's participation in academic developmental activities, attitude toward teaching, etc, that is, interest in academic growth.

(11) teacher's effectiveness in creating interest in pupil (X_{11}) :

Information Data Sheet for teachers (IDSt) was also evolved by the present investigator to collect necessary information for variables (8) to (11). It has been placed as Appendix L (English Version; Appendix -S)

(12) academic achievement of pupils (X_{12}) :

In grades I to IV, three academic subjects, namely, Gujarati, Mathematics and Environment are being taught all over Gujarat. Achievement tests in these subjects for all the four grades were developed anew by the present investigator (Appendices M,N and O)

5.4 DATA COLLECTION ON INDEPENDENT VARIABLES

5.4.1 Intelligence as Measured By Draw-a-Man Test

As discussed in section 2.2.4 in chapter II, cognition and intelligence are not synonymous. Taking into consideration the age-groups of subjects as well as cultural environment (tribal area), the operational definition of cognition as "knowing" (the simplest form) had been accepted. Intelligence is a very broad term and includes many mental entities. It was, therefore, decided to include this variable as an independent variable. Again, in order not to have any type of overlapping in content of the tool used to measure 'cognitive growth and development' on one side and 'intelligence' on the other side, Draw-a-Man test was used to estimate intelligence.

In the beginning, Pratima Phatak's Draw-a-Man test was utilised for pupils of grades I and II. But it did not serve its purpose at all, on tribal children. The supervisor, J.H. Shah was directly connected to "Developmental Norms Project" - a nationwide project of NCERT, New Delhi, at Ahmedabad centre during years 1964-68. He, therefore, suggested to use "Incomplete Man" - a line drawing of a human
figure with one arm and one leg in place of a blank sheet to draw a human figure as was in Pratima Pathak’s test. This adoption worked absolutely very well. The total sample of grades I and II was administered “Incomplete Man” (Appendix G) with necessary instructions, in a group, by the present investigator. Similarly, Pratima Pahtak’s Draw-a-Man test 7 (with revised scoring scheme) was administered to the entire sample of grades III and IV. (Appendix H) Raw scores were utilised in canonical analysis, as norms for tribal children were not available. The present investigator would like to standardise these two separate tests on tribal children as a post-doctoral study; she had already collected data for estimating reliability and validity of these tests.

For all the grades, there was no fixed time-limit. All pupils were given liberal time to draw a human figure to their own satisfaction. In grades I and II, the range of time taken was from 2 to 5 minutes, including encouragement to be given to some pupils as per standardised instructions. In grades III and IV, the same range was from 2 to 6 minutes.

5.4.2 Visual Recall - Immediate and Delayed

In British Ability Scales developed by (Late) Colin D. Elliot with David J. Murray and Lea Pearson, there are 5 scales pertaining to memory. First two of them are (I) Immediate Visual Recall and (II) Delayed Visual Recall. These subtests were adapted and standardised by Sudha Patel 8 under the supervision of J.H. Shah. Here, there is a card wherein there are 20 line drawing pictures. The card is to be shown to the subjects of 5 to 17.5 years range. The subject is asked, “I want you to look at these pictures, while I name them. Look carefully because I want you to try to remember as many as you can.” The investigator has to name at about one word per second and simultaneously she has to point to each picture. The time-limit is two minutes. Then the subject has to recollect the names.

While adapting it, three pictures were totally replaced, eight pictures were bit modified while remaining nine pictures were kept as they were. The picture-card used by Sudha Patel has been shown in Appendix I.

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The present investigator administered this test individually to 10 children of the grades I to IV in the school Jambua in the Dahod Taluka of Panchmahal District. The objective of this pilot study was to conform that the tribal children should be able to recognise each picture and should name it. It was observed that some pictures required replacement or some modifications. With the help of the supervisor, the present investigator made necessary changes and administered the test again to the same 10 children and then, to other 10 children of the grades I to IV.

The present investigator incorporated the following changes in the picture-card adapted by Sudha Patel on the sample of Ahmedabad city only, so that the tribal children could recollect each picture by naming it.

1. The volley ball was replaced by the kite
2. In place of pliers, a pair of tongs (used in kitchen) was provided.
3. The kitchen knife was replaced by a scythe.
4. A small house with a roof of tiles replaced the staircase
5. The foot-rule was replaced by a slate with written words.
6. A small kerosene-lantern was used in place of an electric-bulb.

Thus six pictures were totally replaced by new ones. Only small modifications were made in some pictures so that the tribal children could visualize them very easily. These pictures were: a chair, a bullock-cart, a truck, a pair of chapels, a rose, a tree, a bamboo-basket, a bicycle and a cobra. The modified picture-card has been presented in Appendix J. One can easily visualise the modifications made by the present investigator by comparing these two picture-cards (Appendixes I and J).

The present investigator utilised this adapted picture-card for immediate memory. The same card was also used for delayed memory but it was seen that an interval about 20 to 25 minutes must elapse before the second administration of delayed memory. From the prior-experience, maximum time allowed for recall was increased by one minute, that is, to three minutes as tribal children underwent this type of experience for the first time. This was the only change made by the present investigator in the administration. For classes I & II administering time- 3 minutes.
for observation and 10 minutes for writing; for classes III & IV - 2 minutes for observation and 8 minutes for writing. Time interval between immediate and delayed memory was kept at 20-25 minutes.

5.4.3 Personal - Social Variables

To collect necessary data about the pupils as well as socio-economic status of parents Information Data Sheet (IDSp) was developed by the present investigator which was to be filled in by the parents in the presence of the teacher. In case of illiterate parents, the data were collected by the teachers visiting their homes. The IDSp aimed at getting the following information:

1. Number of siblings
2. Birth order
3. Pupil's inclination towards education
4. Pupil's personality traits
5. Socio-economic status of the parents

It took about 35 to 40 minutes for filling the complete data sheet. The parents and the teachers fully co-operated in collecting these data. The present investigator demonstrated how to fill in IDSp to the class-teachers of grades I to IV, in the beginning and also, clarified the queries to their satisfaction. The IDSp developed for parents has been appended as Appendix K. (Its English Version is placed in Appendix R.)

For scoring this data sheet, two other experts were consulted and the arbitrary weighted scores to be given to different responses were finalised.

These data have been presented as under

<table>
<thead>
<tr>
<th>No Of Siblings</th>
<th>Arbitrary Weighted Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>→ 10</td>
</tr>
<tr>
<td>2</td>
<td>→ 8</td>
</tr>
<tr>
<td>3</td>
<td>→ 6</td>
</tr>
<tr>
<td>4</td>
<td>→ 4</td>
</tr>
<tr>
<td>5 or more</td>
<td>→ 2</td>
</tr>
</tbody>
</table>

Maximum Score: 10
(II) Birth-order

1st —> 10
2nd —> 8
3rd —> 6
4th —> 4
or above

Maximum Score . 10

(III) Pupil’s inclination towards education

a) Homework done regularly 5
Moody or by pressure 3
Feeling boredom 1
Not done 0

b) Time for study

> 2 hrs 5
>1<2 hrs 3
< 1 hrs 1
Not at all 0

c) Interest in going school

Yes 3
No 0

d) Pupil’s study

Good 5
Mediocre 3
Weak 1
Failure 0

e) Result of Annual Examination (if conducted)

Rank - 1 to 5 or 5
% of marks >70%
Rank - 6 to 10 or 3
Marks: 55% to 70%
Rank - 11 to 30 or 1
Marks 35% to 54%
Rank> 30 or 0
Marks <35%
f) Parent’s interest

Yes  3
No   0

Maximum Score • 26

(IV) Personality traits

+ve (+1) for each
seven factors Maximum 7

-ve (-1) for each
seven factors Maximum -7

Maximum Score • 7

(V) SES (Socio Economic Status)

(a) Education:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Weighted Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>10th grade or more</td>
<td>10</td>
</tr>
<tr>
<td>8th to 10th grade</td>
<td>8</td>
</tr>
<tr>
<td>5th to 7th grade</td>
<td>6</td>
</tr>
<tr>
<td>First to 4th grade</td>
<td>4</td>
</tr>
<tr>
<td>Can sign only</td>
<td>2</td>
</tr>
<tr>
<td>Illiterate</td>
<td>0</td>
</tr>
<tr>
<td>+ special training (any type)</td>
<td>3</td>
</tr>
</tbody>
</table>

Maximum Score : 13

b) Education

<table>
<thead>
<tr>
<th>Grade</th>
<th>Weighted Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>5th or more</td>
<td>10</td>
</tr>
<tr>
<td>4th</td>
<td>8</td>
</tr>
<tr>
<td>3rd</td>
<td>6</td>
</tr>
<tr>
<td>2nd</td>
<td>4</td>
</tr>
<tr>
<td>1st</td>
<td>2</td>
</tr>
<tr>
<td>Illiterate</td>
<td>0</td>
</tr>
</tbody>
</table>

Maximum Score : 10

159
c) Occupation of Parents

<table>
<thead>
<tr>
<th>Nature</th>
<th>Weighted Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professional</td>
<td>10</td>
</tr>
<tr>
<td>Business (own shop)</td>
<td>8</td>
</tr>
<tr>
<td>Skilled worker</td>
<td>6</td>
</tr>
<tr>
<td>Farming (own land)</td>
<td>6</td>
</tr>
<tr>
<td>Farming (other's land)</td>
<td>3</td>
</tr>
<tr>
<td>Unskilled labourer</td>
<td>3</td>
</tr>
<tr>
<td>Maximum Score: 10</td>
<td></td>
</tr>
</tbody>
</table>

d) Income of Parents

<table>
<thead>
<tr>
<th>Total Income of house</th>
<th>Weighted Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;Rs 2000</td>
<td>10</td>
</tr>
<tr>
<td>1001-1999</td>
<td>8</td>
</tr>
<tr>
<td>501-1000</td>
<td>6</td>
</tr>
<tr>
<td>301-500</td>
<td>5</td>
</tr>
<tr>
<td>201-300</td>
<td>3</td>
</tr>
<tr>
<td>&lt;200</td>
<td>1</td>
</tr>
<tr>
<td>Maximum Score: 10</td>
<td></td>
</tr>
</tbody>
</table>

e) House-facilities

<table>
<thead>
<tr>
<th>Type of House</th>
<th>Weighted Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Two storeyed (well built)</td>
<td>7</td>
</tr>
<tr>
<td>One-storeyed (well-built)</td>
<td>5</td>
</tr>
<tr>
<td>Common House (Kachha)</td>
<td>3</td>
</tr>
<tr>
<td>Mud House with iron sheet</td>
<td>2</td>
</tr>
<tr>
<td>Grassy house</td>
<td>1</td>
</tr>
<tr>
<td>Maximum Score: 7</td>
<td></td>
</tr>
</tbody>
</table>
(ii) **House size**

<table>
<thead>
<tr>
<th>Size</th>
<th>Weighted Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 rooms</td>
<td>5</td>
</tr>
<tr>
<td>2 rooms</td>
<td>3</td>
</tr>
<tr>
<td>1 room</td>
<td>1</td>
</tr>
<tr>
<td>Separate kitchen</td>
<td>3</td>
</tr>
<tr>
<td>Facility of bathroom/toilet</td>
<td>3</td>
</tr>
</tbody>
</table>

Maximum Score: 11

(iii) **Light facility**

<table>
<thead>
<tr>
<th>Weighted Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
</tr>
</tbody>
</table>

(iv) **Woven stripped beds**

<table>
<thead>
<tr>
<th>No. of Beds</th>
<th>Weighted Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 or &gt; 3</td>
<td>3</td>
</tr>
<tr>
<td>&lt; 3</td>
<td>1</td>
</tr>
</tbody>
</table>

(v) **Other furniture**

<table>
<thead>
<tr>
<th>Weighted Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
</tr>
</tbody>
</table>

(vi) **Radio / Transistor**

<table>
<thead>
<tr>
<th>Weighted Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
</tr>
</tbody>
</table>

Maximum Score: 29

Maximum total SES Score: 72

In this section 5.4.3, independent variables - (iii) to (vii) - \( X_3 \) to \( X_7 \) - have been discussed and the scheme of weighted scores have been presented. Some socio-economic status scales in Gujarati Version were available; they were, however, not suitable for tribal people. The socio-economic environment was altogether different. To develop SES scale, there was a special session with some teachers, headmasters of some schools, in the presence of the supervisor. Two active presidents of taluka panchayat were also invited, in that session. There was a live discussion and its outcome was the present development of SES scale for tribal children and parents. IDS\( p \) was filled in by either the present investigator (for the demonstration purpose) or the teachers concerned in the presence of parents or pupil's father/elder brother. It was used for the specific sample who had completed both the sessions of PiCT. The final sample for analysis comprised of 182 cases.
5.4.4 "Teacher' Effectiveness" Variables

One cannot deny the importance of the influence of teacher’s effectiveness on the cognitive growth and development of a pupil. Again, effectiveness of the teacher depends on many aspects, namely, his educational qualifications, experience of teaching, attitude toward the profession, interest in pupils, etc. A separate Information Data Sheet for teachers (IDSt) was evolved covering only a few aspects that are directly effective for cognitive development of the pupil. Its objective was to collect data about class-teachers concerned, on the following aspects:

(1) Educational Qualifications of the teacher
(2) Teaching experience of the teacher
(3) Teacher’s participation in the developmental growth in education
(4) Effectiveness in creating the pupils’ interest in learning.

Here also, two experts were consulted for framing and modifying the tool developed by the present investigator. The arbitrary weighted scores for different responses were also decided with the help of experts. The scoring system that was finalised was as follows.

(i) Educational Qualifications

<table>
<thead>
<tr>
<th>Education Qualifications</th>
<th>Weighted Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>P.T.C./Basic training</td>
<td>5</td>
</tr>
<tr>
<td>Jr. P.T.C./Pre. P.T.C.</td>
<td>3</td>
</tr>
<tr>
<td>Untrained</td>
<td>1</td>
</tr>
<tr>
<td>Maximum Score</td>
<td>5</td>
</tr>
</tbody>
</table>

(ii) Educational Experience

<table>
<thead>
<tr>
<th>Years</th>
<th>Weighted Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>11 or more years</td>
<td>5</td>
</tr>
<tr>
<td>6 to 10 years</td>
<td>3</td>
</tr>
<tr>
<td>3 to 5 years</td>
<td>2</td>
</tr>
<tr>
<td>2 or below it</td>
<td>1</td>
</tr>
<tr>
<td>Maximum Score</td>
<td>5</td>
</tr>
</tbody>
</table>
Teachers' Participation (Interest in academic growth)

a) Participation in educational activities

<table>
<thead>
<tr>
<th>No of activities</th>
<th>Weighted Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 or more</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>None</td>
<td>0</td>
</tr>
</tbody>
</table>

b) Participation in workshops, seminars, etc.

<table>
<thead>
<tr>
<th>Number</th>
<th>Weighted Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 or more</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>None</td>
<td>0</td>
</tr>
</tbody>
</table>

(iv) Effectiveness in creating the pupil's interest in education

<table>
<thead>
<tr>
<th>Satisfaction</th>
<th>Weighted Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full satisfaction</td>
<td>7</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>5</td>
</tr>
<tr>
<td>Moderate satisfaction</td>
<td>3</td>
</tr>
<tr>
<td>not satisfied</td>
<td>1</td>
</tr>
<tr>
<td>no effect</td>
<td>0</td>
</tr>
</tbody>
</table>

Maximum Score 7

This IDSt was filled in by class-teachers themselves. In all, 24 teachers filled in this data sheet. IDSt has been appended as L. (Its English Version has been appended as Appendix S.)

5.4.5 Academic Achievement

Primarily this study was brought on as a survey and was eventuated into a correlational study; it was not, at all, aimed at exploring cause-effect relationship between any two variables such as predictor (treatment) and criterion variables, as
were used in an experimental research. It was, therefore, decided to have academic achievement as an independent variable and just study the relationship between cognitive ability and academic achievement.

It was decided beforehand to collect the data for achievement in three academic subjects—Gujarati, Environment, and Mathematics together, as an independent variable. The present investigator, first of all, tried to locate if any achievement test for grades I to IV was available. Of course, there was not a single test available in which the sample of tribal pupils was taken up or was included. The present investigator was quite aware of the fact that she had to make modifications in the tests available and had to establish item-validity for the selected items. Besides, she was not going to standardise these tests by establishing norms, reliability, validity, etc. for these achievement tests.

Achievement tests of Mathematics were available which had been constructed by Pratibha Shah for her Ph.D. Study under the supervision of J.H. Shah and achievement tests of Gujarati were also available from the project of Gujarati department of school of languages in Gujarat University undertaken by Vyas and Bhandari. Development of achievement tests for tribal pupils of grade I to IV have been presented in detail, subject wise.

(A) Mathematics

One of the sub-objectives of Pratibha Shah’s study was to construct four different tests of mathematics for pupils of grades I to IV to verify whether the essential learning outcomes in pupils as prescribed in the original syllabi were fulfilled. The present investigator used these available mathematics tests for grades I to IV for carrying out pre-piloting and piloting in Sahada and Jambua schools respectively with a view to select items suitable for the tribal children and to reduce the number of items so as to have the tests of about half an hour duration each. The original tests framed by Pratibha Shah required one hour time for each test.
All the achievement tests were administered in Jambua School of Dahod Taluka in Panchmahals on a sample of 39, 42, 54 and 56 (after discarding some cases for reasons discussed earlier, for constructing CogAT) subjects of grades I to IV respectively for the purpose of item-analysis. In all the three academic subjects, the same procedure of 27% method for item analysis was used and Facility value (FV) as well as Discrimination Index (DI) were determined by the same formulas that were used in the development of cognitive ability tests. The necessary items having FV between 18% to 84% and DI between 0.20 and 0.67 were retained for the final run.

Fifteen short answer type items were selected in all the four mathematics tests. Besides, some sums (Do as directed) were included to have a content coverage of the whole syllabus for grades II to IV. Time-limit to complete each test (including all types of instructions) was fixed up to 30 minutes—quite liberal one. Table 5.3 presents FV and DI Values of selected items, grade wise. It should be noted that the arrangement of items was not from easy to difficult; it was contentwise.
### TABLE 5.3

**FACILITY VALUES AND DISCRIMINATION INDICES OF SELECTED ITEMS IN ACHIEVEMENT TESTS OF MATHEMATICS**

<table>
<thead>
<tr>
<th>Sr No of the Item</th>
<th>Grade I N=39 (E=11)</th>
<th>Grade II N=42 (E=11)</th>
<th>Grade III N=54 (E=15)</th>
<th>Grade IV N=56 (E=15)</th>
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<td>DI</td>
<td>FV</td>
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<td></td>
</tr>
<tr>
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<tr>
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<td>16 d</td>
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</table>

One specific feature of testing sessions for the final run was that the administration of all types of achievement tests (three subjects) was carried out in July, after 15 to 20 days of the new academic year. The vacation period must have marred the immediate achievement scores. It could rather be considered as retention scores. It was quite obvious that all the achievement tests were to be administered to pupils of grades II, III, IV and V as it was just starting of a new academic term. In early March, item analysis was carried out for all the achievement tests. Hence, the
present investigator had to carry out the final run on the entire sample of six schools, in July only.

For grades I & II, there were verbal tests. Many pupils of grades I and II in the tribal area were not able to follow written instructions as well as some items, too. Such pupils were given individual assistance by providing a pupil of either grade VI or VII as a helper. He would only read out the items and would note the testee’s reply only. The administration of tests was carried out in the presence of the investigator herself as well as two to three teachers who acted as proctors. There was not such a problem to be faced in grades III and IV and these pupils themselves tickmarked the correct responses. Achievement Tests in Mathematics used in this study for Grades I to IV, in a revised form, have been appended as Appendix M.

(B) Environment

These tests were developed anew by the investigator herself, keeping in view the item-validity as the foremost criterion. It was pre-determined that each test should consist of 15 items only and the time-limit should be liberal, that is, half an hour should be allowed. The items were to be of multiple-choice type items having four alternatives (three distractors) and were based on the content of the textbook. One illustration and two practice items were to be given. To have a broad spectrum of choice, it was decided to coin double items in number, that is, 30 items in each test.

Possible wrong answers were put as distractors in each item. Experienced teachers and experts were consulted to check up whether the items satisfied the expected learning outcomes. While framing the items, adequate care was taken to see that the items were, more or less, connected with the tribal environment. It was, then, finalised after consulting the supervisor.

Each test was prepiloted with the same objectives as were mentioned in the development of cognitive ability tests on 10 pupils, individually. It was found that many pupils of the grade I were not able to read the instructions as well as the items, themselves. It was, then, decided to read out the instructions as well as item-
question orally in the item-analysis study as well as in the final run. Almost each pupil was provided with a helper, the latter being the pupil of the grade VI or VII. From grade II and onwards, there was no problem of comprehension.

The tests were then administered to the same pupils who were administered tests of mathematics for item-analysis. The final selection of the sample for item-analysis was kept the same as that was used for achievement tests of Mathematics. The same number of subjects was retained in item-analysis of achievement tests of Gujarati too, that is, it was 39, 42, 54 and 56 for grades I through IV. The Facility Value & Discrimination Index of all items were calculated. The items having FV between 18% to 91% and DI between .18 to .55 were selected. Out of them, 15 items each were selected after consultation with the supervisor. The items were arranged in descending order of FV i.e. from easy to difficult. FV and DI values of the selected items of all the four tests for different grades have been shown in Table 5.4. The tests were then printed & administered. The administration was carried out in presence of the investigator herself as well as three teachers who acted as proctors. The achievement tests in 'Environment' used in this study for grades I to IV have been placed in Appendix N.
### TABLE 5.4

**FACILITY VALUES AND DISCRIMINATION INDICES OF SELECTED ITEMS IN ACHIEVEMENT TESTS OF ENVIRONMENT**

<table>
<thead>
<tr>
<th>Sr No of the item</th>
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<th>Grade III N=54 (E=15)</th>
<th>Grade IV N=56 (E=15)</th>
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</table>

(C) **Gujarati**

The achievement tests developed by Yogendra Vyas and Arvind Bhandari of Gujarat University were administered in the school of Sahada for pre-pilot study. However, in the context of the tribal area, it suffered from the following major pitfalls:

a. The written tests were not suitable for grades I & II
b. It was very time consuming, taking about 1 to 1½ hours.

c. The items were not of multiple choice type.
d. The items were not totally based on the content of text-books, as it was a "Basic Vocabulary" Project.
e. Item-analysis was not carried out.
To have harmony within all the achievement tests, it was resolved to develop new tests of Gujarati in the same fashion as those of Mathematics and Environment. Of course, some items in each test were taken from the available tests of Gujarati, in a modified form. Here also, for grade I, the instructions and the items were read out orally and the pupil indicated his response to the helper (a pupil of grade VI or VII) who would record it by drawing a line below the response. For the purpose of item-analysis, 30 items were coined for each grade. Five experienced teachers and instructors were consulted to check up whether each item of the test measures the pre-determined essential learning outcomes. It was then finalised after consulting experts and her supervisor.

The tests were, then, piloted on the same sample of Jambua school. It was found that except two pupils in classes I and II, all others responded to the tests with care and full cooperation. However, the sample for item-analysis was selected randomly to have the same number of pupils gradewise, that is, 39, 42, 54 and 56 for grades I to IV. The total time taken was recorded very carefully. It was in the range of 50 to 60 minutes. The pupils of grades I and II took little more time than those of grades III & IV.

FV and DI Values of all the items were calculated. The items having FV between 17% to 91% and DI between 0.18 & 0.55 were selected. Out of them, 15 items in each test were taken after consultation with the supervisor. The FV and DI of selected items were presented in Table 5.
TABLE 5.5

FACILITY VALUES AND DISCRIMINATION INDICES OF SELECTED ITEMS IN ACHIEVEMENT TESTS OF GUJARATI

<table>
<thead>
<tr>
<th>Sr. No.</th>
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<th>Grade IV N=56 (E=15)</th>
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</table>

The time limit of 30 minutes was fixed for full administration (including the time for instructions). The tests were then printed and administered. The administration of the test was carried out in the presence of the investigator as well as two teachers who acted as proctors. The achievement test for Gujarati used in this study for grades I to IV are appended in Appendix O.

5.5 SUMMING UP

The present investigator has presented in detail how she collected the data of fourteen different measures for thirteen variables. It was, no doubt, a very time-consuming process. But she really enjoyed it. In the next two chapters analysis of data have been presented and the discussion of the results has also been done simultaneously; no separate chapter has been provided for it.
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