CHAPTER V
TEST CONSTRUCTION

5.0 Introduction

5.1 Test Items
5.1.1. Verbal creativity
5.1.2. Figural creativity
5.1.3. Numerical creativity

5.2 Try out process
5.2.1. Pre-pilot Tryout
5.2.2. Final Tryout
5.2.3. Response Analysis
5.2.4. Test scoring
5.2.5. Final Form of CAT

5.3 Testing Procedure
5.3.1. Sample selection
5.3.2. Administration

5.4 Nature of Population
5.4.1. I.Q. difference
5.4.2. Streams difference

5.5 Test Norms

5.6 Test Reliability and Validity
5.6.1. The Reliability of the test
5.6.2. Establishment of Validity
5.7 Test used

5.7.1. Creative Ability Test

5.7.2. Environment Test

5.7.3. Creative Personality Inventory
5.0 INTRODUCTION:

The planning is one of the essential steps in order to carry out any work systematically and scientifically. For a strong outcome the planning is emphasized in any type of research work. The planning gives the easier way to attain goal. While planning the basis objectives must be kept in view constantly. The importance of planning and the process of planning have already been discussed in the previous chapters. The main objective of the present investigation is to construct a reliable and valid scale for measuring the creativity among the higher secondary school students and to relate the creativity with the variables such as streams, I.Q. and student's environment.

5.1. TEST ITEMS:

To prepare the ground for the types of the test items some of the existing theories of the creative test as referred under Chapter III of this study are reviewed. According to Gestalt view, the various types of test items covering the different problems are as under:
1. Ask-and-guess test
2. Consequences task-test
3. Product improvement task-test
4. Unusual uses test
5. Impossibilities task-test
6. Just suppose task-test
7. Situations test
8. Common problems test
9. Similarities test
10. Line pattern test
11. Figure pattern test.

Looking to above some task-tests are to be selected covering the varied items for this study due to following demarcations:

1. The type of items selected should be used in a group, so that the test could be widely used.

2. Test items should be selected in such a way that the responses must be in a verbal form.

3. Each of the test items should be such that the respondents would response the test item in a good number of ways i.e., uncommon way and in various categories.

4. The test item selected should be from the work in which he lives.

5. Numbers of items should be selected in such a way that the test might not be a lengthy one.
In the previous study done so far the selected test items mainly depended on verbal and figural creativity (majority) but the investigator has decided to include some test items depending on basic mathematical knowledge also. Thus the test has three types of items:

1. Verbal creative test items
2. Figural creative test items

5.1.1. Verbal Creativity:

The test items are selected from Koggon and Wallach test and Passi's test. Verbal creativity test items itself is a stimulus which is in a verbal form. There are three types of verbal techniques viz., Instances, Alternate use and Similarities. However, for this test first two types of verbal techniques are selected on the basis of basal try out of the items as under:

(I) Instances:

The student is asked to generate possible instances of a class concept that is specified in verbal terms. The two items in this technique are accepted in the order of administration as shown under:

1. "Name all the ROUND things you can think of".
2. "Name all the SQUARE things that you can think of".
3. "Name all the things you can think of that makes noise."
4. "Name all the things which are AUDIBLE."

(II) Alternate uses:

In this technique, the student is asked to generate possible uses of a verbally specified items. The four items are included in this type of process:

1. "Tell me all the different ways you can use a NEWSPAPER."
2. "Tell me all the different ways you can use a CHAIR."
3. "Tell me all the different ways you can use a TIN."
4. "Tell me all the different ways you can use a piece of CLOTH."

5.1.2. Figural Creativity:

The test items are selected from Koggon and Wallach test and Passi's test. This is one of the two creativity assessment techniques involving visual rather than verbal stimulating materials. In this technique a figure is presented before a student and he is asked to generate possible meanings and interpretations also on the abstract visual design. The three test items included in this type of process are:

Part - I: Line meaning:

(i)
Part - II: Pattern Meaning:

(i)

(ii)

(iii)
5.1.3 **Numerical Creativity:**

This type of test is prepared by the investigator which involves the basic mathematical knowledge of a student. The test items include the concept of numerical form, mathematical operations, indices, basic algebraic knowledge etc. The student is instructed to generate the possible ideas he could while reaching the item. The four types of test items selected under this topic are as follows:

(1) **Numbers:**
   
   (a) Make as many numbers as possible by using the digits, 1, 2 and 3.

   (b) Make as many numbers as possible by using the digits 1 - 5 (In each number, each digit may be used only once).

(2) **Sum:**

   (a) Make as many sums as possible with the digits 1 - 5 which gives 6 as a total.

   (b) Make as many sums as possible with the digits 1 - 6 which give 6 as a total (in each sum, each digit may be used only once).

(3) **Making Number:**

   (a) Use 5, Five times and make as many numbers as possible. (Only 5 should be used).

   (b) Use 4, Four times and make as many numbers as possible.
(4) **Making equation:**

(a) Make equation having solution - 1. (Limiting to one variable).

(b) Make equation having solution - 2.

5.2. **TRY OUT PROCESS:**

Some of the creative test items for verbal and figural are selected as discussed ahead while the third part of the numerical creativity test items are constructed. All the test items are to be scrutinized scientifically and rationally. With a view to preparing a test for the elementary school. The investigator comes to know only after the try-out how the respondent understands the problem, how he interprets the given data and how he arrives at the conclusions. The try-out is to be done in two stages as under:

(i) Pre-pilot try-out.

(ii) Pilot try-out.

5.2.1. **Pre-pilot try-out:**

The pre-pilot tests contain 24 test items in total viz. 8 verbal creative test items as part I, 8 figural creative test items as part II and 8 numerical creative items as part III. The pre-pilot is given to very small group of students possessing the above an average ability. To conform the applicability of the test is the main objective of this pre-pilot try-out,
hence no statistical calculations needed at this level. Thus specific objectives of this try out can be kept in mind as listed below:

1. To check whether the students of different grade follows the instructions clearly.
2. To confirm whether the student follows the language of the test items.
3. To find out, if there is any ambiguity in the test items.
4. To see whether items work well with the students i.e., students can react properly to the items and can respond in the diversified ways.
5. To determine the time limit for each of the items.
6. To decide whether a relaxation period of interval is needed or not.

It would be more appropriate to discuss the findings along with the observations of this tryout in three categories as under:

**Category - I: Part - I: Verbal Creativity:**

**Observations:**

1. The students cannot give a good number of responses to particular items.
2. The languages of instructions and problem is easy to follow.
3. A small note book with 20 pages can serve the purpose as an answer booklet.
4. The students can write down the items correctly as announced by the experimenter.

5. A few items are found to be difficult, being of higher level.

6. Average time per item is noted to be five minutes.

Important conclusions regarding this tryout are drawn from the above observations as listed here:

1. It is finalised that 5 minutes should be given to each items in Part I.

2. Principal copies of items with answer sheet are found very convenient.

3. Difficult and easy items are dropped out and the six items are finalised for the part one.

Part - II: Figural Creativity:

Observations:

1. Language of instruction and problem is easy to follow.

2. A few items are very interesting.

3. It is difficult to draw the picture from the board.

4. Time is sufficient.

5. A few items were found to be difficult.

Conclusions:

1. The language of instruction is found appropriate.

2. It is finalised that 5 minutes should be given to each item.
3. The difficult and easy items are dropped out and six items are finalised in part two for pilot try out.

**Part - III: Numerical Creativity**

**Observations:**
1. The time is more than its requirement.
2. The language of instruction and problem is easy to follow.
3. The items are found to be interesting.

**Conclusions:**
1. The language of instruction is appropriate.
2. It is finalised that 5 minutes should be given to each item.
3. The difficult and easy items are dropped out and four items are finalised for try out in part three.

Thus the investigator has come to the decision for the number of items to be included in each part of the pilot test.

**5.2.2. Pilot Tryout:**

After the selection of test items, the next step is to prepare the test booklet with the space for the responses for each test item included in pilot test form. As described in earlier caption, there are three sub-tests in the test-booklet vide Appendix - 4. The classification of items included in each of the sub-test is made and shown in the
The pilot try out was carried on with the following objectives:

1. To acquaint with the administration of the present creativity test.

2. To observe the reaction of the pupils to the items of varied nature.

3. To make the response analysis of the responses obtained from the subjects under study.

4. To select the test items on the basis of the response analysis.

### Table: 5.1 below:

<table>
<thead>
<tr>
<th>Subtest</th>
<th>Creativity</th>
<th>Content of the test</th>
<th>Item No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Verbal</td>
<td>Instances</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Alternative uses</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>Figural</td>
<td>Line meaning</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pattern meaning</td>
<td>2</td>
</tr>
<tr>
<td>3.</td>
<td>Numerical</td>
<td>Numbers</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sum</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Making Numbers</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Making equations</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total items</strong></td>
<td></td>
<td></td>
<td><strong>18</strong></td>
</tr>
</tbody>
</table>
5. For this purpose the investigator has to take care of the following points while administering a test:

(i) Instruction in the test
(ii) Report establishment
(iii) Time limit
(iv) Composition of sample.

(i) Instructions:

Instructions used for pilot testing should be similar to those for final testing. From the observations of pre-pilot tryout, some instructions with modifications are prepared. The instructions are prepared in two phases:

(a) General instruction
(b) Specific instruction

(a) General instruction:

The general instructions impart the most basic tasks understanding and needs of this testing vis. (Appendix - I).

* Fill up the requirements as soon as you get the booklets.
* This is not an examination, but it is a different type of test. It is a test to know how one thinks and how much one can think.
* This includes three parts. Think in your mind according to the given instruction. You like it and you feel it.
* You have to note down your ideas in a good number in the place given under the item in each part.
Please note down the extra answers of test items on the last page.

Thus the bio-data of each subject under study is collected and each one would feel that this is not an examination but is a thrust to thinking about a situational item in a varied modes.

(b) **Specific Instructions:**

As this creative tests contain three parts viz., verbal creativity, figural creativity and numerical creativity, the specific instruction are prepared according to the clarification required in each part (Appendix - A).

**Part - I:**

* One can think freely in many ways.

* If we take edible things, we would get many names of the edible things viz. Rice, Sweet balls, Biscuits, Apple, salt etc.

* You can make a long list of such things.

* In this section, you are given 6 items, three items of instances and three of alternate uses.

* You can think very well and you can give an idea different from the ideas given by other students.

**Part - II:**

Observe the given figures minutely and freely so that you would have a sparing of ideas.
* If you observe a circle 0, you would get different ideas viz., full moon, zero, ring, bangle etc.

* You can think as differently as other could think.

* In this part you are given two types of items:
  (1) Line meaning
  (2) Pattern meaning.

Part - III:
* Here patiently the instruction given to you so that you can read it in different ways.

* If you are asked to express 4 you can express it in many different ways viz., $2 + 2$, $5 - 1$, $12 + 3$, $2 \times 2$, $2^2$.

* In this part you would be given the instruction about some mathematical concepts and operations though, you can have many responses.

Thus, by specific suggestions, students would be motivated to react with the test items by noting the ideas evolved in the fruitful mind of the student in a free atmosphere. The student would be confident that he is able to give response to the item included in the test. But the investigator should build a good rapport with the subjects under study while trying out of the test.
(ii) **Establishment of rapport:**

The success of any test depends upon how the respondents have understood the problem and how they think under free mental condition. So the care is taken to assure that the testers have established rapport with pupils before the test administration. Tester has explained the examples listed in the test booklet in detail before the commencement of test.

Thus this type of rapport provides understandings among the respondents.

(iii) **Time Limit:**

As this test is not a speed test but a power test, the time limit for the test is fixed such as to give an opportunity to all the individuals to attend all the test questions. In our study the responses are obtained as data in a particular situation in a classroom. Hence the time limit is fixed in such a way that student can respond in various categorial ways. In pre-pilot tryout 5 minutes for each test item in a test item is given resulted in to higher number of responses.

(iv) **Composition of sample:**

The pilot tryout was made on the selected High Schools in urban and rural area of Mehsana district and for getting better item analysis and scoring key the selection of science arts and commerce college is also done.
The category-wise students in total selected are as shown in table:

**TABLE: 5.2**

Composition of sample for pilot try out

<table>
<thead>
<tr>
<th>Grade</th>
<th>Science</th>
<th>General Arts and Commerce</th>
<th>Technical</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>10</td>
<td>14</td>
<td>6</td>
<td>30</td>
</tr>
<tr>
<td>XI</td>
<td>10</td>
<td>14</td>
<td>6</td>
<td>30</td>
</tr>
<tr>
<td>XII</td>
<td>10</td>
<td>14</td>
<td>6</td>
<td>30</td>
</tr>
<tr>
<td>F.Y.</td>
<td>12</td>
<td>18</td>
<td>-</td>
<td>30</td>
</tr>
<tr>
<td>S.Y.</td>
<td>12</td>
<td>18</td>
<td>-</td>
<td>30</td>
</tr>
<tr>
<td>T.Y.</td>
<td>12</td>
<td>18</td>
<td>-</td>
<td>30</td>
</tr>
<tr>
<td>Total</td>
<td>66</td>
<td>96</td>
<td>18</td>
<td>180</td>
</tr>
</tbody>
</table>

5.2.3. **Response Analysis:**

The response analysis should not be based on statistical calculation like correlation, hypotheses testing. This test was meant for the measurement of the creativity levels of the Higher Secondary school students. So it was necessary to analyse the responses according to the levels of creativity. According to B.K. Passi, the responses less than 10% were to be considered a highly creative and the responses having percentage between 12% to 28% were called normally creative or common responses.
Responses to this task were evaluated along with the three different components of creativity: Fluency (N), Flexibility (G) and Originality (U). First two components were found easy to score but the third component originality was found to be difficult. From the review of the Torrance Test at creativity developed by B.P. Torrance. The procedure adopted to measure originality was worth to brief before the response analysis work shown below:

<table>
<thead>
<tr>
<th>Response in Percentage</th>
<th>Scale value</th>
</tr>
</thead>
<tbody>
<tr>
<td>12% and more</td>
<td>0</td>
</tr>
<tr>
<td>5% to 12%</td>
<td>1</td>
</tr>
<tr>
<td>2% to 5%</td>
<td>2</td>
</tr>
<tr>
<td>1% to 2%</td>
<td>3</td>
</tr>
<tr>
<td>Less than 1%</td>
<td>4</td>
</tr>
</tbody>
</table>

Gira C. Vora had classified the responses of all the items in the Divergent Thinking Programme into three categories as under:

1. 0 to 10%  Highly Creative Person
2. 11 to 28% Normal Creative Person
3. Above 28%  Non-creative Person

Looking at the all above systems the investigator had adopted the classification system for the response analysis of Gira C. Vora mentioned as above.
The responses of each item in the tests were analysed as a whole. The responses given by more than 28% students were neglected and all these responses are shown in the Appendix.

During the response analysis, the observations were made by the investigator as follows:

1. The responses were obtained in a good number for the items in Part I viz., verbal creativity, while the number of responses to the items in Part II i.e. figural creativity are less.

2. A good number of categories of the responses were found for the items in Part I i.e. verbal creativity while less number of categories of the responses were found for the items in Part II i.e. figural creativity.

Even though, the Numerical Creativity Test (Part III) was a new type of test, a good number of responses and good number of categories were found for these items. But it was a hard task to categorize the responses. To score uniqueness i.e. Originality, the unique responses were determined and to make scoring easy it is a one point for unique responses. It is found that this system seems to be simple and facilitates the usability of creative test.
5.2.4. **Test Scoring:**

As there are no right or wrong responses for the test, much care has to be exercised at the time of establishing the method of scoring the test. The following points have to be kept in mind:

1. The percentage of responses observed for each item in the fourth-going caption should be accounted for its effectiveness.

2. Each Test item is to be scored for number, as number is represented by the number of relevant and un-repeated ideas which the testee gives.

3. Each test item is to be scored for category as category is represented by a person's ability to produce ideas which differ in approach or thought trend.

4. Each test item is to be scored for uniqueness as it is represented by uncommonness of given responses i.e., responses given by less than 5% of the group are treated as unique.

On the basis of percentage of responses and number of groups of responses, the investigator had decided whether the item in test is going to be retained or is going to be dropped. Item number 3 and 2 in Part I, 3 and 1 in Part II and 2 and 2 in Part III have already been dropped and the remaining items have been reframed in the form of the test.
The following points should be kept in mind while scoring the remaining items in the test:

1. **Scoring for Number (N):**

   In scoring for number, the scorer should go through the responses to the item in question carefully and strike off those which are irrelevant and have been wrongly coded. He should then count the remaining number of responses in N (Appendix I3).

2. **In scoring for category (C):**

   From each item of the test the investigator has determined the various categories of responses by response analysis. For easyness the alphabet serial was given to the categories of the responses say A, B, C, D,... (Appendix) and should note in the bracket against their responses by the letter showing the category to which it belong. Then he should count the number of category and this number shows the category score.

3. **Scoring for uniqueness (U):**

   As has been decided in previous caption, uniqueness scoring is done on the basis of percentage statistics for uncommoness of responses. If a responses has been given by 5% or less than 5% of the subjects, the responses would get an uniqueness score of one number of such unique response would give the uniqueness score U (Appendix V).
The total number (fluency) category, (flexibility) and uniqueness (originality) would give a total creativity score on creativity ability test (Appendix V).

5.2.5. **Final form of CAT:**

From the addicate and appropriate response of the pilot test, the most important thing is to select the test items for the final form. The due care should be taken for the following:

1. Number of responses having various categories.
2. Number of responses to be very uncommon or unique.
3. Three sub-tests of CAT viz., verbal, figural and numerical creativity.
4. Natural responses but most appropriate one.
5. Interest in responding the item through observations made.
6. The length of the test.

In view of the above points the investigator has rejected items for the pilot test and has accepted four items to be included in each part I, PartII and part III as shown in table 5.3 below:

<table>
<thead>
<tr>
<th>Part</th>
<th>Title</th>
<th>Description</th>
<th>Pilot</th>
<th>Final</th>
</tr>
</thead>
<tbody>
<tr>
<td>I.</td>
<td>Verbal</td>
<td>1. Instances</td>
<td>1, 2</td>
<td>1, 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Alternate uses</td>
<td>4, 6</td>
<td>3, 4</td>
</tr>
<tr>
<td>II.</td>
<td>Figural</td>
<td>1. Line meaning</td>
<td>7, 8</td>
<td>5, 6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Pattern meaning</td>
<td>9, 10</td>
<td>7, 8</td>
</tr>
<tr>
<td>III.</td>
<td>Numerical</td>
<td>1. Number</td>
<td>11</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Sum</td>
<td>13</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Making Number</td>
<td>16</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Making equation</td>
<td>18</td>
<td></td>
</tr>
</tbody>
</table>
As this test is meant for H.S.C. school students, the investigator had prepared a creative ability test with a blank sheet for the responses to be noted by the students (Appendix V). Illustrations for each point were explained thoroughly. The instructions in general were printed on the first page of this test in brief.

The next work was to commence the CAT test on selected sample of subjects.

5.3 Testing Procedure:

After finalizing the final form of the creative ability test, the next step was to implement the test to the subjects, undertaken as a sample for the population known as the H.S.C. school students. Therefore, the first phase of the execution of the test was to select a proper and adequate sample for the population.

5.3.1. Sample selection:

As discussed in the previous chapter, a stratified or quota sampling procedure has been adopted. According to Garette "Stratified sampling is also called controlled sampling." It is a technique designed to ensure the representation and avoid biases by use of a modified random sampling method.

Keeping in view this definition, it was decided to administer the test practically in the H.S.C. school students of Mahesana district. This stratification is relatively homogeneous for common speaking language is Gujarati. Hence
sampling within the strata was random so that every individual in strata had equal chance of being chosen. The following procedures were considered in selecting the sample:

1. Stream : Science, General, Technical
2. I.A. : Levels of I.Q.
3. Sex : Boys and Girls
4. Environment : Levels of Environment

For the selection of representative sample, the investigator had selected the H.S.C. schools of Mahesana district situated in urban and rural areas (Appendix - XIV).

The following table shows the stream wise higher secondary school students' distribution of the population scored for the study:

Table: 5.4

Data of stratified sample under study

<table>
<thead>
<tr>
<th>Index schools</th>
<th>Streams</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Science</td>
<td>General</td>
</tr>
<tr>
<td>Rural</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>20</td>
<td>25</td>
</tr>
<tr>
<td>2</td>
<td>15</td>
<td>26</td>
</tr>
<tr>
<td>Urban</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>25</td>
<td>21</td>
</tr>
<tr>
<td>4</td>
<td>25</td>
<td>24</td>
</tr>
<tr>
<td>5</td>
<td>25</td>
<td>27</td>
</tr>
<tr>
<td>Total</td>
<td>110</td>
<td>123</td>
</tr>
</tbody>
</table>
5.3.2. **Administration:**

Then the creative ability test is administered to the representative sample of students selected as shown in Table: 5.4. The whole testing programme commonly lasted from July, 1988 to January, 1989. The test administrator had communicated the basic factors namely general guideline, specific instructions, explanation of the practice-items and the time duration etc.

(a) **General Guideline:**

The test administrator has to keep in mind the general guidelines for himself. So the following general guidelines should be observed during testing:

* The general tone of atmosphere of the classroom should be warm, friendly and one where the optimism prevails.

* One should be totally uninterested in neatness, punctuation and spelling. These things are important but there should not be worry or distraction when the children are trying to think independently.

* Encourage the student to listen carefully to what he reads and to observe minutely the figure outforth before him.

* Try to avoid threats and to pass any remark on the responses given by the students.

* Explain the illustrations in each subject, so that their interest might be maintained.
* For the lower grade the tester should take the help of one or two teachers.

Thus the general guidelines would help the test administrator in building a rapport with the class and creating motivational class climate.

(b) Specific Directions:

Along with the general guidelines some specific directions should be kept in mind while administering the test in a class. They are as follow:

* Distribute the test booklets among the class. The students should be asked to fill the personal data in a given blank on the test booklet.

* The tester should read the general instructions slowly with proper intonation, so that the student can understand well.

* He should ask students to turn over the page and to observe the illustration given in the first part of the test.

* The time limit for each item in every sub-test was of 5 minutes. The completion of time limit was learned by time keeper (time piece).

* The tester should provide motivation to the students if he finds the class non-responding with the time duration.

* Tester should not take round in the class room.

* Do not pass remark on the student's responses but feel free to explain if a child does not understand a situation.
* If a student finishes his work early, try to motivate him to increase responses from the view of quality and quantity.

* If students require enough time to respond the items, tester should give more time, to respond it at his own.

* Do not worry about a student who gives less responses for the test items. If a student gives new responses try to help him individually to think for further suggestions.

* On completing a test booklet within the time limit, collect all test booklets and give a chance to respond if a student wishes to respond without time limit.

The responses without time limit are not considered in measuring the creative levels of the students. The time schedule for administer the test taken is described in the new caption.

(c) **Time Schedule:**

Approximately 20 weeks were required in order to carry out the research with each class of about 25 to 30 students.

First the creative ability test was administered to the students and after seven days CAT was administered. The data observed on CAT for standardized process of test. The observation made during the test administration.
5.4 NATURE OF POPULATION:

The obtained data on creativity scale are used to have frequency distribution, keeping in view the sex, areas and grade. The frequency distribution of the score obtained by girls and boys studying in the classes XI and XII of streams science, general and technical and coming from rural and urban areas is shown below in the table: 5.5 and moreover the total frequency distribution is shown in the last column of the table.

Table: 5.5

Frequency distribution of the pupils in two ways

<table>
<thead>
<tr>
<th>Scores interval</th>
<th>I.Q.wise frequency</th>
<th>Stream-wise frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>101 to 125</td>
<td>00</td>
<td>02</td>
</tr>
<tr>
<td>126 to 150</td>
<td>04</td>
<td>12</td>
</tr>
<tr>
<td>151 to 175</td>
<td>08</td>
<td>16</td>
</tr>
<tr>
<td>176 to 200</td>
<td>15</td>
<td>17</td>
</tr>
<tr>
<td>201 to 225</td>
<td>17</td>
<td>23</td>
</tr>
<tr>
<td>226 to 250</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>251 to 275</td>
<td>17</td>
<td>26</td>
</tr>
<tr>
<td>276 to 300</td>
<td>16</td>
<td>14</td>
</tr>
<tr>
<td>301 to 325</td>
<td>14</td>
<td>13</td>
</tr>
<tr>
<td>326 to 350</td>
<td>21</td>
<td>06</td>
</tr>
<tr>
<td>351 to 375</td>
<td>14</td>
<td>04</td>
</tr>
<tr>
<td>376 to 400</td>
<td>09</td>
<td>04</td>
</tr>
<tr>
<td>401 to 425</td>
<td>05</td>
<td>01</td>
</tr>
<tr>
<td>426 to 450</td>
<td>06</td>
<td>01</td>
</tr>
<tr>
<td>451 to 475</td>
<td>05</td>
<td>01</td>
</tr>
<tr>
<td>476 to 500</td>
<td>02</td>
<td>01</td>
</tr>
<tr>
<td>Total</td>
<td>183</td>
<td>161</td>
</tr>
</tbody>
</table>

Mean | 288.50 | 241.41 | 301.66 | 251.80 | 251.05 | 267.21 |
SD   | 73.64  | 70.68  | 85.48  | 73.82  | 61.34  | 79.90  |
Median| 276.28 | 238.82 | 304.67 | 238.78 | 253.47 | 258.99 |
The frequency distribution shown in the last column in the above table: 5.5 is then smoothened, and its statistics are computed which shown in the table: 5.6.

Table: 5.6

Frequency distribution of total population and its statistics (N = 344)

<table>
<thead>
<tr>
<th>Class interval</th>
<th>F</th>
<th>F smooth</th>
<th>Computed</th>
<th>Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>101 to 125</td>
<td>02</td>
<td>6.0</td>
<td>Mean</td>
<td>267.21</td>
</tr>
<tr>
<td>126 to 150</td>
<td>16</td>
<td>14.0</td>
<td>Median</td>
<td>258.99</td>
</tr>
<tr>
<td>151 to 175</td>
<td>24</td>
<td>24.0</td>
<td>S.D.</td>
<td>79.90</td>
</tr>
<tr>
<td>176 to 200</td>
<td>32</td>
<td>32.0</td>
<td>Q.1</td>
<td>208.0</td>
</tr>
<tr>
<td>201 to 225</td>
<td>40</td>
<td>37.1</td>
<td>Q.3</td>
<td>319.94</td>
</tr>
<tr>
<td>226 to 250</td>
<td>40</td>
<td>44.3</td>
<td>Q</td>
<td>55.97</td>
</tr>
<tr>
<td>251 to 275</td>
<td>53</td>
<td>41.0</td>
<td>P.10</td>
<td>167.58</td>
</tr>
<tr>
<td>276 to 300</td>
<td>30</td>
<td>36.7</td>
<td>P.90</td>
<td>376.65</td>
</tr>
<tr>
<td>301 to 325</td>
<td>27</td>
<td>28.0</td>
<td>S.K.</td>
<td>0.309</td>
</tr>
<tr>
<td>326 to 350</td>
<td>27</td>
<td>24.0</td>
<td>K.U.</td>
<td>0.268</td>
</tr>
<tr>
<td>351 to 375</td>
<td>18</td>
<td>19.3</td>
<td>Mode</td>
<td>248.55</td>
</tr>
<tr>
<td>376 to 400</td>
<td>13</td>
<td>12.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>401 to 425</td>
<td>06</td>
<td>8.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>426 to 450</td>
<td>07</td>
<td>8.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>451 to 475</td>
<td>06</td>
<td>5.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>476 to 500</td>
<td>03</td>
<td>3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Smoothed Frequency Distribution is shown in the graph No. 5.1
5.4.1. I.Q. Difference:

The first step in the fixation of norms is to observe if I.Q. difference prevails for this, the data of table 5.6 are considered for statistical computation. The following table 5.8 shows the computation for difference between the means of both the I.Q. groups of H.S.C. groups.

Table: 5.7

Significance of difference between the means of I.Q. level

<table>
<thead>
<tr>
<th>I.Q.</th>
<th>Mean</th>
<th>S.D.</th>
<th>N</th>
<th>Difference of means</th>
<th>S.ED</th>
<th>t</th>
<th>Rema- (REC)</th>
<th>rks</th>
</tr>
</thead>
<tbody>
<tr>
<td>High I.Q.</td>
<td>288.50</td>
<td>73.64</td>
<td>183</td>
<td>Significance</td>
<td></td>
<td></td>
<td></td>
<td>6.04</td>
</tr>
<tr>
<td>Low I.Q.</td>
<td>241.41</td>
<td>70.68</td>
<td>161</td>
<td>47.09</td>
<td>6.04</td>
<td>7.79</td>
<td>6.04</td>
<td></td>
</tr>
</tbody>
</table>

The observed value of the critical ratio (RCE) is 6.04 to examine the difference between mean value of High I.Q. and mean value of low I.Q. The observed 't' value is 6.04 which is greater than table value 2.58 at 0.01 level. It shows that the difference between High I.Q. students and Low I.Q. students in creativity is significant. Hence the following null hypothesis is not accepted:

Ho: There is no significant I.Q. difference in creative ability measured on creative test. So it is concluded that I.Q. difference prevails in their creative ability by them.
5.4.2. **Streams Difference:**

The second step in taxation of norms is to observe if the streams difference prevails for the data of table. 5.6 are considered for the further statistical computation. The following table 5.8 shows the computation for significance of difference between the means of the science and general streams, general and technical streams, science and technical streams.

Table: 5.8

<table>
<thead>
<tr>
<th>Streams</th>
<th>N</th>
<th>Mean</th>
<th>S.D.</th>
<th>Difference of mean</th>
<th>S.ED.</th>
<th>CR (T)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Science</td>
<td>108</td>
<td>301.66</td>
<td>85.48</td>
<td>49.84</td>
<td>10.58</td>
<td>4.71</td>
</tr>
<tr>
<td>General</td>
<td>123</td>
<td>251.82</td>
<td>73.82</td>
<td>0.77</td>
<td>8.81</td>
<td>0.087</td>
</tr>
<tr>
<td>Technical</td>
<td>113</td>
<td>251.05</td>
<td>61.34</td>
<td>50.61</td>
<td>10.04</td>
<td>5.04</td>
</tr>
</tbody>
</table>

The observed values of the critical ratio (CA(t)) are 4.71, 0.087 and 5.04 to examine the difference between mean value of science, general and technical streams.
The observed t value for the mean difference on creative ability of school students studying in Science and General, Science and Technical are 4.71 and 5.04 respectively is greater than the table 't' value 2.58 at 0.01 level. Hence this stream difference is significant but the stream difference of the students studying in General and Technical is not significant. Hence the following null hypothesis is rejected:

\[ H_0^2 : \text{There are no significant differences in creative ability of the students studying in Science, General and Technical streams.} \]

So it is concluded that the stream difference exists in the creative ability of the higher secondary school students.

Looking towards the mean score of science and that of two other streams are 301.66 and 251.45 respectively, it is concluded that the students of science stream is better than the students of other one. Symbolically it is shown as

\[ \text{(Science)} \geq \text{(General - Technical)} \]

5.5 TEST NORMS:

The norms may be defined as an estimate of some characteristics of a distribution of the test scores for a specified population. According to E.F. Lindquist,
norms describe the actual performance of specified groups; of individuals.

The population under study is known as the Higher Secondary school children. It is a group of students, studying in streams viz., Science, General and Technical. In the preceding section, I.Q. wise and stream wise studies have been described and the conclusions are as follows:

(a) There is significant I.Q. difference in the creativity of the students,

(b) There is significant stream difference in the creativity of the students.

As determined in the Chapter IV, the norms of the test would be established as below:

I. Standard Score norms: σ score, Z score

II. Percentile Rank Norms

III. Stannine Score

IV. Letter Norm

\[
\text{σ score} = \frac{x - \bar{x}}{\sigma}
\]

\[
Z \text{ score} = \left(10 \times \frac{x - \bar{x}}{\sigma}\right) + 50
\]

The standard scores have been shown in table 5.10.

The percentile ranks are calculated for the Higher Secondary school students by using the formula:

\[
P_R = \left[\frac{(P_P - 1)}{i} \frac{f_p + F}{i} \right] \times \frac{100}{N}
\]
The percentile ranks for each raw score obtained on creative ability test have been shown in ready table which is attached in Appendix VI.

The 'Stannine' is derived from the words 'standard' and 'nine'. The Stannine score runs from 1 to 9, along the base line of the normal population curve constituting a scale in which unit is 0.56 and median 5, as recommended by Garrett. The Stomine scores of the sample under study are computed equivalent to creativity score in R.R. table.

As the raw score ranges from 124 to 495 the investigator had divided the creativity levels of the higher secondary school children into 5 levels known by A, B, C, D, E, letters. 'A' level and so on the five levels had been decided by dividing the basal 60 by 5. The letter grade has been shown in the R.R. Table.

Table: 5.9

Test-Retest Reliability co-efficient of the 3 sub-tests and whole tests

<table>
<thead>
<tr>
<th>Sub-test</th>
<th>Person r</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Verbal</td>
<td>0.92</td>
</tr>
<tr>
<td>2. Figural</td>
<td>0.79</td>
</tr>
<tr>
<td>3. Numerical</td>
<td>0.91</td>
</tr>
<tr>
<td>Whole test</td>
<td>0.85</td>
</tr>
</tbody>
</table>
With the help of this ready reckoner table the test administrator can convert the raw score of the creativity ability test into standard scores, percentile rank. If the need arises to know the creativity level of the school students their levels could be determined by this table.

5.6 **TEST RELIABILITY AND VALIDITY:**

Research always depends upon measurement. Two important constructs in measurement are validity and reliability. The construct of any psychological test can never be considered as complete unless it is tested for its reliability and validity.

For determining the reliability of present test, the following two methods were applied:

1. Test-retest Reliability.
2. Split-half Reliability

The reliability of 3 sub-scale and the whole test were computed by the above two methods.

For establishing the validity of the test, the investigator depended on construct validity. The validity of the test was assessed by computing correlation between the total test score and the score on the sub-test using product moment method.

The inter-sub test correlation was also computed by the project moment method to determine the validity of the test.
For this purpose, three schools from Mehsana district were selected randomly and from which 80 students were selected randomly. It was used for reliability and validity.

5.6. THE RELIABILITY OF THE TEST:

For determining the reliability of the test, two methods were used.

5.6.1. Test-retest Reliability:

The test-retest method is employed to compute the reliability for both the groups of students viz., boys and girls. A group of 43 students of each sex was given the creative test and retest after 25 days of the first testing. The person \( r \) between the two sets of scores was computed and test-retest reliability of 3 sub-test was also computed. The obtained test-retest reliability coefficient for the 3 sub-scales and for the whole test are given in table 5.9.

From the above table, it is observed that the whole test 3 sub-tests enjoy a high reliability.

5.6.2. Split-half Reliability of the coefficient of the 3 sub-tests and the creative ability test:

The test on the odd and even, items were taken separately on the sample of 80 subjects, 43 boys and 37 girls. The product moment coefficient of correlation were computed between the tests on odd and even items. The reliability
coefficient computed was correlated applying Pearson Brown Prophacy Formulas. The correlated reliability coefficient of 3 sub-scales and creative ability test was computed and are shown in the table: 5.10.

Table: 5.10
Split-half Reliability coefficient of 3 sub-tests and whole test

<table>
<thead>
<tr>
<th>Sub test</th>
<th>Pearson 'r'</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Verbal</td>
<td>0.89</td>
</tr>
<tr>
<td>2. Figural</td>
<td>0.82</td>
</tr>
<tr>
<td>3. Numerical</td>
<td>0.92</td>
</tr>
<tr>
<td>Whole test</td>
<td>0.91</td>
</tr>
</tbody>
</table>

The reliability test employing the split-half method reveals that the creative ability test scale and 3 sub-scales enjoy a high reliability. Hence, it is concluded that the creative ability test scale is found to be reliable one.

5.6.2. Establishment of Validity:

The validity of scale was established by the method of internal consistency in three ways:

(a) Proper care was taken to maintain the validity of the test at the time of the construction of items and item analysis. The high discriminatory power of items i.e. higher than 2.58 significant at 0.01 level is a testimony to the internal consistency.
(b) The validity of test was assessed by computing the correlation between the total test score and the score on each sub-test using the product moment method. Computed values of Pearson 'r' are shown in Table 5.11.

**Table: 5.11**

<table>
<thead>
<tr>
<th>Sub test</th>
<th>Pearson 'r'</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Verbal</td>
<td>0.83</td>
</tr>
<tr>
<td>2. Figural</td>
<td>0.78</td>
</tr>
<tr>
<td>3. Numerical</td>
<td>0.81</td>
</tr>
</tbody>
</table>

This correlation shows that the sub-tests enjoy high validities.

(c) Inter-sub-tests correlations were also computed by the product moment method to determine the validity of the test. The computed Pearson 'r' i.e., inter correlations between 3 sub-scales are shown in Table 5.12.

**Table: 5.12**

<table>
<thead>
<tr>
<th>Sub-test</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>0.76</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>0.82</td>
<td>0.77</td>
<td>-</td>
</tr>
</tbody>
</table>
The inter-correlation shows that the sub-tests enjoy high validity within themselves. The reliability of the present tests ranges from 0.77 to 0.82. The coefficient is high enough to conclude. The test is highly reliable and valid.

Hence the Creative Ability Test for higher secondary students has been standardized. Therefore, the scores on creativity scores were put to the process of Analysis in the next chapter.

5.7 TESTS USED:

5.7.1. Creative Ability Test:

The CAT was developed by the investigator and was used for the purpose of measuring the creativity level of the pupils. (Appendix-IV)

5.7.2. Environment Test:

To measure the environment condition among the subjects, the environment test adopted and translated, given in 'The Fourth Eye' by Prof. Khandwala in Gujarati language keeping in view the Indian culture. The translation was referred to the linguistic person for its truthfulness and correlations.

The test consisting of the four environmental conditions was divided into four sub-tests:

(1) Home environment  (3) Social environment
(2) School environment  (4) Study environment
Each set of ten scales concerned a particular fact of one's environment. The environment test is prepared considering in home environment - a child's parents in social environment - school activities, teachers and study in social environment - friends, elders, relatives and social circle and in study environment curricular and method of study etc.

* The manuscript test was conducted among the 25 Nos. of students who were given the creativity pre-pilot test during the same time because the aim was to consider its understanding among the students.

* On the results of the manuscript test the following changes were made for the final environment test. The student did not understand the sentences with the technical terms were explained in a still simple language and the list giving explanation, was prepared and was given along with the final test.

* With the above changes new environmental test was constructed and was given among the group of students and again given retest to them. Based on the test-retest method and reliability was worked out.

The final environment test was constructed with the following instructions in the regional language i.e., Gujarati. The translation of the instructions in English is as under:

1. This questionnaire contains the statements covering your
different environmental conditions for each statement give your personal view.

2. Five different choices are given under each statement out of which one is to be marked as per the subject feeling.

3. You have to attempt all the statements of every part and give your personal view regarding the same.

4. Let us see method of answering by an example:

Example: In school my view is heard at peacefully. 1, 2, 3, 4, 5

For this statement I think my view is heard at the school peacefully to the extent to I will tick out 2 related to question.

5. Some technical terms were used in the statements. The simple explanation of the same is also given under the list appended so please refer to the list with explanation of necessary before giving your view.

6. No time limit is fixed for this test.

Scoring key:

In each four parts of the test the following marks were allotted for the first five statements:

<table>
<thead>
<tr>
<th>Choice No.</th>
<th>1, 2, 3, 4, 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marks allotted</td>
<td>5, 4, 3, 2, 1</td>
</tr>
</tbody>
</table>
For the remaining five statements the following marks were adopted in each of the four parts of the test for the scoring key:

<table>
<thead>
<tr>
<th>Choice No.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marks allotted</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

Thus the student can maximum secure 50 marks and minimum of 10 marks in each of the four parts. The total marks for the test is 200. (Appendix VII)

By using the above scoring key among the test result of the students in final test the environmental condition was worked out as under:

1. Using the scoring the individual marking was done.
2. The students whose individual marking was above the median was taken.

Under good environmental and whose individual marking was below the median was taken under poor environmental condition.

The final environmental inventory was given to the same students which were given the C.A.T. final test.

The reliability and validity of environment inventory are 0.89 and 0.86 respectively.
5.7.3. **Creative Personality Inventory:**

To measure the teacher's creativity, the creative personality inventory which prepared by psychologist Eugene Randsepp is used. This creative personality inventory is translated in Gujarati language. The translation is referred to the linguistic for its corrections.

This inventory included mainly two sections:

1. **Your choice of responses shows creativity:**

   In this activity there are certain conceptual and situational statements regarding creative personality. The teachers should check the responses that they told apply to them.

2. **In this activity there are given certain adjectives regarding creative personality the teacher should check the adjectives that they believe describe them.**

The copies of creative personality inventory (CPI) and its scaling are shown in Appendix. \( \aleph \).

The CAT was administered to the students under study and the creative personality inventory was given to the teachers concerned of the different streams. Here the collected data work for the process of analysis is in the next chapter.