3.0.0 Introduction

Planning is an essential step to undertake any work and complete it with efficiency and economies. Without a comprehensive plan a research work would yield no specific outcomes worth the name. A good plan helps a researcher to make his work precise and faultless. The chief objectives of the research to be undertaken must be kept in view while planning it. The main objectives of the present investigation are to construct and standardize a tool to measure 'Creative Thinking Ability' of students of age group 11 to 13 in general and to study 'Creative Thinking Ability' as a function of sex, age, area, SES and some personality traits in particular.

3.1.0 Need of the Tool

For studying creative thinking ability in general and as a function of some factors mentioned in the above para in particular, valid and reliable tools are badly needed. Therefore, the first and foremost task before the investigator was to procure and study the tools available in the market. The researcher could procure the reliable and valid tools for collecting information about socio-economic status and personality traits included in the study. However, there was not a single tool available in the market which was suitable
for measuring three major factors viz., fluency, flexibility and originality. Hence the investigator took up the task of constructing and standardizing the tool for the purpose of the project. The researcher thought it proper to carry out the entire work into two main phases. The phases are:

1. Construction and standardization of 'Creative Thinking Ability Test'.

2. Study of the creative thinking ability as a function of certain variables like SES, Age, sex, personality traits, etc.

3.2.0 Construction of the Creative Thinking Ability Test (C.T.A.)

This phase includes selection of right type of techniques for the construction of the scale. For this the items measuring the creative thinking ability were studied from various types of creative thinking ability tests constructed by experts in the field. The investigator studied such items as can entail three major functions of fluency, flexibility and originality and considered them as the model items for his work. He followed the instructions pertaining to such items fully and he constructed about 25 items and sent them to various experts for their opinion. After reading the comments of the experts the items which were parallel and poor in structure were dropped. The items which needed a
little bit of modification were modified. Hence, the investiga-
tor could select 18 items which fully matched with the
criteria of fluency, flexibility and originality. These
items were tried out and after making them pass through various
tests, were finally selected. These items were included in
the final try-out. The reliability, validity and norms were
established for the 'Creative Thinking Ability Test'.

3.2.1 Preparation of the Tool

For the preparation of the creativity test, first of all
the investigator looked into various types of methods adopted
in the construction of a creative thinking ability test. This
tool generally does not follow the fixed response technique
adopted in I.Q. measurement tests. This is a test which meas-
ures the creative thinking ability which is largely based on
divergent thinking. Hence, the items would get responses more
than once. There are several methods evolved for this purpose
by experts like Guilford, Torrance, Wallach and Kogan, Mednick,
Barron, etc. The investigator studied the different techniques
and evolved a suitable method for the construction of the
scale. Guilford has considered the following five factors
of divergent thinking: fluency, flexibility, originality,
elaboration and evaluation. Majority of the tests are framed
covering as many aspects of these as possible.
3.2.1 Model of the present Test

From the study of the different tests in this area the investigator thought it proper to construct a scale around the three aspects, viz., fluency, flexibility and originality. The two factors, elaboration and evaluation, have not been included in the present scale.

3.2.3 Steps

i. The investigator first of all studied the available tests on creative thinking ability. They were as follows:

1. Torrance:
   Torrance Tests of Creative Thinking.

2. Baker Mehdi:
   (i) Verbal Test of Creative Thinking.
   (ii) Non-Verbal Test of Creative Thinking.

3. Passi B.K.:
   Passi Tests of Creative Thinking.

4. Kaul B.P.:
   Test of Creative Thinking
   Test of Creative Thinking.

ii. After this, several experts in the field were consulted and the items of the test on various aspects of creativity were thoroughly discussed.
iii. These items were individually administered to the students to find out their reactions and responses.

iv. Item-wise sorted out responses and reactions were presented before the experts for their analytical opinions.

v. According to their advice some of the items were omitted and some of the items which needed modifications were modified and retained. Some items did not need any modification. Thus a pool of items on three aspects were prepared and administered to only a few students in the form of a pre-try-out testing.

vi. Thus a pilot test was constructed and was ready for pilot administration. The instructions for each item were duly checked.

vii. After pilot testing, item analysis work was carried out with the help of statistical techniques.

viii. The final selection of the items was done and the format of the test was prepared.

ix. The final test was administered to 1000 students for establishing norms. From the same sample 200 students were randomly selected and they were administered the test again for establishing test-retest reliability.
These students were also administered the Torrance test for establishing validity of the test. These students were also administered the test of "Check the Activity Done by yourself from the Test". The final score on this test was also used as an external criterion for establishing validity.

3.3.0 Test Items

Introduction

In this chapter the investigator has fully described steps up to item analysis and the remaining two steps of the preparation of the final test and the establishment of reliability, validity and norms of the test are given hereafter.

3.3.1 Types of Items

Generally the patterns of the test items have been kept the same but the contents of the items are different. The items were constructed on the following six different patterns:

i. If such thing happens, what would be the consequences.

In this type of items one imaginary situation is provided and the respondee is asked to list down as many consequences as he could think of. For this task five minutes' time is allotted.
ii. Find out the similarities between the items of a pair. 
Here the respondee has to find out as many relationships as he could imagine. For this pattern five minutes' time for recording the responses is given.

iii. Find out the unusual uses of the given items. 
In this pattern the respondee has to record down as many uses as he could think of for a given item. For listing down the responses to each item five minutes' time is given.

iv. Prepare a list of similar things. 
In this item the respondee is given a particular item and he is asked to write down as many similar things as are available. For each item five minutes' time is given.

v. To see the deficiencies in a given item. 
The respondee is asked to find out the deficiencies or faults in a given thing. In this item also five minutes' time for recording the responses is given.

vi. Test of inquisitiveness. 
In this pattern the respondee has to raise as many questions as he thinks of for a given item. Here also the respondee is given five minutes' time to record his responses to a given item.
Thus the investigator has included six patterns, each with two items and the total time provided for each pattern is ten minutes. Hence the total time of test administration does not exceed 70 minutes.

3.3.2 Judges Agreement

The investigator prepared four items on each of the six types of tests. Hence in all 24 items were constructed. These items were shown to the experts with a view to getting critical evaluation on three points, viz., (i) structure, (ii) content and (iii) instructions. The experts agreed to keep not more than three and not less than two items on each aspect. They excluded about six items judging them from their face value. Consequently there remain 18 items in the entire test.

3.3.3 Pre-piloting of the Test

The test items were arranged in the following order:
Table 3.1

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Test aspect</th>
<th>No. of items</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>If such thing happens what would be the consequences</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>Find out the similarities between the items of a pair</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>Find out the unusual uses of the given items</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>Prepare a list of similar things</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>Find out the deficiencies in a given item</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>Raise as many questions as possible</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>24</strong></td>
</tr>
</tbody>
</table>

3.4.0 Experimental try-out of the Test

It is acknowledged by the prominent test constructors that the outward appearance and framing of the test items do not guarantee that the items would behave exactly in the expected manner. For this each item must be tried out before its inclusion in the final form of the test.

"No matter how carefully the test content is planned or how expertly the test items are prepared; there is no guarantee that the items would actually 'behave' the way they are expected to".  

Consequently the investigator decided to try out the items keeping the following objectives in view:

i. To identify weak as well as effective items from the lot.

ii. To find out ambiguity from an item and remove it so as to make it self explanatory.

iii. To determine the discriminative power of each item with a view to making selected items contributing to the central purpose of the finished test.

iv. To find out the appropriate time limit for the final form of the test.

v. To select efficient and adequate number of items in each of the sub-tests to constitute an efficient measuring instrument.

The try-out process appears very simple. However, it requires immense patience, extra care and exactness on the part of the investigator. The sample which was selected for the try-out was very carefully chosen.

3.5.0 Try-out Form of the Test

It has been frequently advised by the field experts that approximately 50% more items should be constructed. This would put the investigator in safer position to select exact and adequate number of items for the final form of the
test. This would also enable him to give proper weightage to the varieties of items in his blue-print. Ross and Stanley Julian have rightly stated:

"For each sub-division of the test, from 20 to 50 per cent more items should be prepared than are likely to be required."2

The time factor is a very important element for the final form. The investigator studying the pros and cons of the time factor came to the conclusion that the total time for the test should not exceed approximately one hour and fifteen minutes. The investigator planned to devote at least five minutes to each item. It appears from the nature of the items that if for each aspect minimum two items are included the time needed for each aspect would be ten minutes and one or two minutes' rest would be given between two aspects. Thus in all approximately it would not exceed the time budget of one hour and fifteen minutes. As the investigator is advised by the experts that there should not be more than three items in each sub-test the investigator, looking to the nature of the sub-tests and entire test, decided not to have more than three items in each sub-test. Hence there would be approximately eighteen items in all. They are given in the table 3.2

### Table 3.2

**NUMBER OF TEST ITEMS INCLUDED IN EACH SUB-TEST OF TRY OUT FORM OF THE C.T.A. TEST**

<table>
<thead>
<tr>
<th>Sub-test No.</th>
<th>Type of Activity</th>
<th>Activity</th>
<th>Total No. of Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>If such thing happens what would be the consequences</td>
<td>1. If the rooms of the school are flying in the sky what would happen. 2. If all men can make their bodies fat or thin as they wish what would happen. 3. If men can see in the night as they can see in the day what would happen.</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>Find the similarities between the items of a pair</td>
<td>1. Honey and sugar cubes 2. Snake and Mongoose 3. A dog and a cat</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>Find the unusual uses of the given item</td>
<td>1. Oil 2. A handkerchief 3. A knife</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>Prepare a list of similar things</td>
<td>1. List of the things having saw like teeth 2. List of the things having rought surface 3. List of the things which slide</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>To see the deficiencies in a given item</td>
<td>1. A post card 2. A pencil 3. A sendle</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>Test of inquisitiveness</td>
<td>1. Questions about a tower. 2. Questions about a scooter. 3. Questions about a match-box.</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>18</td>
</tr>
</tbody>
</table>
From the table 3.2, it is observed that there were approximately 50% more items in the try-out form, thus making a fairly reasonable provision of test items in the try-out form of the test.

3.6.0 The Pre-Try-out

The pre-try-out work was undertaken with a view to finding out the gross deficiencies, but there was no intention to analyse the data. The manuscript of the pre-try-out test was given to the experts for their comments and guidance. In the light of their suggestions modifications were made. As Lindquist rightly suggested:

"The tentative-try-out forms may be "dettoed" or may even be carbon copies or type written draft. The pre-try-out may be highly informal."³

After due modifications cyclostyled booklets along with answer-sheets of the pre-pilot test were prepared and administered to 25 students. The main purpose of the pre-try-out was:

i. To see whether the instructions given on each sub-test and on separate items were self explanatory.

ii. To observe procedural details for the administration of the test.

iii. To observe general difficulties encountered by the respondees.

From the pre-try-out work the following observations were made:

i. Ambiguity of instructions posed some problems to the respondees. The ambiguities were orally corrected and noted down for proceeding work.

ii. From the keen observation of the respondees, the investigator comprehended that since the respondees were not accustomed to give this kind of tests, they took little more time than expected.

3.6.1 The try-out of the Test

The investigator consulted the experts and discussed with them at a greater length the observations made by him during the pre-try-out process. The suggested alterations were made and the try-out form was again cyclostyled. The sample for the try-out was 110, representing the entire population for standardization.

The students of this age-group were randomly selected from different talukas of Sabarkantha district. The table 3.3 presents the detail of male-female proportion and urban-rural area proportion.
Table 3.3
SAMPLE FOR THE TRY-OUT

<table>
<thead>
<tr>
<th>Area</th>
<th>No. of subjects</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Boys</td>
<td>Girls</td>
<td>Total</td>
</tr>
<tr>
<td>Urban</td>
<td>25</td>
<td>17</td>
<td>42</td>
</tr>
<tr>
<td>Rural</td>
<td>47</td>
<td>21</td>
<td>68</td>
</tr>
<tr>
<td>Total</td>
<td>72</td>
<td>38</td>
<td>110</td>
</tr>
</tbody>
</table>

To get the correct information regarding the factional efficiency of each item the investigator has taken care to see that the sample should be bias free. Lindquist has rightly pointed out the importance of a bias free sample.

"... the magnitude of the reliability and validity coefficient for the try-out forms are all dependent on the characteristics of the sample of examinees tested." 4

Hence the test was administered to 100 students studying in primary schools. After the collection of the responded answer books, the investigator went through them to scrutinize them fully and to select the completed answer sheets for the further analysis work.

Out of 110 the investigator could get 400 fully answered test books. The investigator himself administered

4. Ibid., p. 253.
the test to all the students included in the sample with a view to having first hand observations. The headmasters and the teachers concerned with the classes extended their co-operation quite enthusiastically to make the students available for the test. Generally the investigator preferred the early hours of the day. The respondents were found quite co-operative in taking the test. They did not show any sign of anxiety or worry or fear of being evaluated. In order to establish rapport with respondents the investigator had some informal talk about the test and purpose of the present research. After administering the test the scoring was carried out in accordance with the pre-determined process.

3.6.2 Surplus items

It was mentioned earlier that 50% more items were included in the try-out form, so that the researcher would get a fair chance to discard the items which did not fit in with the criteria. The items having a low discriminative power were to be discarded from the final test. Surplus items provide enough opportunity to select right type of items.

3.7.0 Item Analysis

The items of the present test do not pass through the difficulty index criteria since the very nature of creativity does not agree with the idea of one correct answer.
and rigidity in responses. These items entertain more fluency, flexibility and originality in the responses. The investigator could use only the discriminative power technique to judge the real power of the respective items.

3.7.1 Discriminative Power

The items correctly responded to by more members of the respondents from the upper group or the superior group than those of the lower group, would prove that the items have a discriminative power. In other words, the respondents who respond more relevantly generally rank higher than those who respond irrelevantly. Discrimination is the basic function of all the educational measurements. It has been mentioned that respondents with superior ability should answer the items relevantly more often than should the inferior respondents. This suggests a method by which the power of a test item to discriminate or distinguish between groups of respondents may be determined. In the present investigation to determine the discriminative index of each item, T.L. Kelley's method was used. For using this method two extreme groups were formed from the answer-sheets of 100 students. These answer-sheets were arranged in the ascending order on the basis of their total score. Then from both the ends 27 answer books were taken out and the middle 46 answer-sheets were not taken into account. These
groups are generally known as upper group and the lower group.
The summary of the analysis of each item for both the groups is given in the table 3.4

**TABLE 3.4**

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Item</th>
<th>Upper Group</th>
<th>Lower Group</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>M</td>
<td>S.D.</td>
<td>M</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>23.32</td>
<td>9.03</td>
<td>7.56</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>24.04</td>
<td>10.32</td>
<td>3.64</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>21.28</td>
<td>12.21</td>
<td>2.68</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>20.06</td>
<td>8.90</td>
<td>2.52</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>16.92</td>
<td>9.62</td>
<td>3.72</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>13.32</td>
<td>7.49</td>
<td>2.68</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>18.32</td>
<td>6.49</td>
<td>8.36</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>21.52</td>
<td>5.06</td>
<td>7.56</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>24.32</td>
<td>10.20</td>
<td>5.88</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>35.64</td>
<td>10.15</td>
<td>12.08</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>19.52</td>
<td>11.10</td>
<td>10.16</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>25.24</td>
<td>14.01</td>
<td>6.88</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>12.6</td>
<td>4.17</td>
<td>3.04</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>9.88</td>
<td>4.52</td>
<td>1.04</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>16.88</td>
<td>6.60</td>
<td>4.32</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>20.76</td>
<td>12.91</td>
<td>4.32</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>10.32</td>
<td>2.81</td>
<td>3.36</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>18.80</td>
<td>11.15</td>
<td>4.00</td>
</tr>
</tbody>
</table>
In table 3.4 it is observed that all the items possess distinct discriminative power and hence the problem for the investigator to select the items for the final form. On the consultation of the experts additional 50% items on the basis of the strength of their high discriminative power items were selected. This method is popular one and is used often in standardizing such tests. Gerbarich has pointed out the value of this method as:

"This method of determining the discriminative power of test items is widely used in the critical analysis of test items for the standardised test."

3.8.0 Selection of Items

After a thorough analysis of these items, the items for the final form of the test were carefully selected. Besides this, the inclusion of number of items and the time factor were also viewed by the investigator very carefully. In order to make the test more precise in measurement, the items for all the three important components such as fluency, flexibility and originality were included in proper relevance in the time factor. The following points were

seriously kept in view while selecting the items for the final test:

i. Items readily matching with pre-determined creative thinking characteristics should be included.

ii. One item in each sub-test with the lowest t-value should be dropped.

iii. Proportion of the time factor should be kept in mind while selecting the items.

On the basis of the above-mentioned points one item in each sub-test area was dropped out. Hence there would be total 12 items, two in each sub-test. Total time for all the sub-tests was kept equal. Two minutes' interval was allotted for rest between two sub-tests.

Re-arrangement of the sub-tests and Test-Items

The nature of the creative thinking ability test is such that no sub-test or item is more difficult than the rest. But there is a factor of apparent amusement in dealing with items. This factor is not equal in proportion in all the sub-tests and items. The investigator personally interviewed some of the students to know which sub-tests were more amusement providing to the students. Roughly, a method of pair judgement was used in determining the most to the least amusing capacity of the sub-test and items as well. According
to this a new arrangement of the sub-test and test items was made. They are presented in table 3.5.

Table 3.5

NEW ARRANGEMENT OF THE SUB-TEST AND TEST ITEMS

<table>
<thead>
<tr>
<th>Sub-Test No.</th>
<th>Type of Activity</th>
<th>Activity</th>
<th>Total No. of Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>If such thing happens what would be the consequences</td>
<td>1. If the rooms of the school are flying in the sky what would happen. 2. If men can see in the night as they can see in the day what would happen.</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>Find the similarities between the items of a pair</td>
<td>1. A cat and a dog. 2. A snake and a mongoose</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Find the unusual uses of the given item</td>
<td>1. A handkerchief 2. Oil</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>Prepare a list of similar things</td>
<td>1. List of the things having saw-like teeth 2. List of the things which slide</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>To see the deficiencies in a given item</td>
<td>1. A pencil 2. A sandle</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>Test of insitiveness</td>
<td>1. Questions about a match box 2. Questions about a scooter</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td>12</td>
</tr>
</tbody>
</table>

It can be concluded that the new arrangement is based on the amusement capacity of the item which would tempt the respondee to take up the items of the test one after another.
3.9.0 Observations

During the experimental try-out it was observed by the investigator that the modified instructions were self-explanatory and there was no need of recording them. Some of the school teachers and head-masters showed great interest in taking the test themselves. Out of one hundred ten, one hundred could attempt all the items enthusiastically. Some of the respondees were inquiring about their thinking ability score. Some of the headmasters and teachers expressed their readiness to administer this test to all the students of the age-group.

In the light of the above discussion, the investigator decided to have an equal number of items in each sub-test with equal amount of time allotted to each sub-test. Hence for attempting the 12 items a respondee would require one hour's time, but as two minutes' rest period is introduced between two sub-tests, the items would require 10 minutes more. Hence in all 70 minutes' time is fixed for the total test. No separate answer-sheet is required for recording the responses. The testees have to write down their answers in the given space.