Chapter 3

Methodology

This chapter describes the method of investigation for achieving the objectives of the formulated problem and to verify the hypotheses.

Sample:

A large sample of 277 participants who consented to participate (125- pilot study plus 152 - final study) balanced on gender (male and female) was employed for the present study.

Figure 3(A): Sample layout of the study

<table>
<thead>
<tr>
<th>Sample (N=277)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pilot study</strong></td>
</tr>
<tr>
<td><strong>Phase -I</strong></td>
</tr>
<tr>
<td>Phase -I (A)</td>
</tr>
<tr>
<td>(30+20+ 20+ 15+10)</td>
</tr>
<tr>
<td>Phase -I (B)</td>
</tr>
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</table>

However, there were several sub-samples; Pilot study, i.e., Phase–I used 125 Ss (95+30). Sample-A of 95 Ss with divisions as 30 Ss for phase -I task-1 and task-2; 20 Ss for phase –I task-3; 20 Ss for phase–I task-4; and 25 Ss (15+10) phase –I task-5. Sample-B: A sample of 30 Ss was used for modulation of Dialectical Reasoning Scale. Final study sample of 152 for phase–II was further subdivided into four groups as 38 Ss high creative and high dialectical reasoning; 38 Ss high creative and low dialectical reasoning; 38 Ss low creative and high dialectical reasoning; and 38 Ss low creative and low dialectical reasoning. These four groups (n=38) performed on five tool used task in Phase-III. The sample consisted of Ss of both sex (M = 76, F = 76) and
within the age range of 18 to 40 years (mean age -29 and SD -6.6). All the Ss were from different fields/areas however large chunk was from colleges. Their educational qualification level varied from Senior Secondary to Masters' level.

**Design:**

*(Procedural & Experimental Design)*

A tri-phasic multi-task, repeated measure design was employed to achieve the objectives of the study. A flow chart/ layout employed in the present study IS presented in Figure -3(B). The experimental designs are given in Figure -3(C) & Figure -3(D).

**Figure 3(B): Procedural design and layout of the study**

<table>
<thead>
<tr>
<th>Phase I Pilot study</th>
<th>Multitask procedure (N = 95)</th>
<th>Pilot Study: (task selection and standardization)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase-II Group assignment</td>
<td>Single Large Group (N = 152)</td>
<td>Dialectical Reasoning and Creativity Testing for grouping into four group of 38Ss each</td>
</tr>
<tr>
<td>Phase-III Experiment (tool use task) Final study</td>
<td>Task 1 Four group of n= 38 Making a meaningful item/common concrete noun and bolt it.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Easy Task 2 Repeated Draw a square diagram</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Task 3 Repeated Transferring material from one bottle to another bottle.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Difficult Task 4 Repeated Make a Lamp Wick</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Task 5 Repeated Make an artificial tree</td>
<td></td>
</tr>
</tbody>
</table>
In pilot study Phase-I there were two objectives: tool selection, moderation and translation of Dialectical reasoning scale in Hindi.

The purpose of Phase-II was to select and divide subjects with high or low dialectical reasoning and further into high and low creativity from a sample of 152 Ss.

In Phase-III, the actual experiment (Testing on selected sample on five task of tool use) was done by utilizing Experimental Design-1 [Figure-3(C)] for Task-I and Experimental Design-2 [Figure-3(D)] for easy and difficult tasks to obtain dependent scores.

**Experimental Design- 1**

It was a 2x2 factorial (separate group) design with two independent variables varied each at two levels and between groups with N = 152 \( n = 38 \times K = 4 \).

**Figure 3(C): Experimental design in phase- III (1)**

<table>
<thead>
<tr>
<th></th>
<th>Creativity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High</td>
</tr>
<tr>
<td><strong>Dialectical Reasoning</strong></td>
<td>38</td>
</tr>
<tr>
<td>High</td>
<td>38</td>
</tr>
<tr>
<td>Low</td>
<td>38</td>
</tr>
<tr>
<td></td>
<td>76</td>
</tr>
</tbody>
</table>

The experiment allowed to record four dependent scores of tool use, viz; the time taken to solve the problem, number of attempts to solve the problem, number of moves to solve the problem, and to perceive number of affordances in the tool or/and materials used in the problem of Task-1 (where the subject was free to solve the problem as per his decision and experiment's instructions). There was no fix solution.
Experimental Design- 2

It was a 2x2x2 factorial design repeated on the last factor. The first two independent variables were same as in design-1. All the dependent scores were also same as in experimental design-1. The sample of 152 Ss was also same. All the subjects were repeated for low and high difficulty tasks. Each difficulty level was operationalized by averaging/ summing up scores on two tasks each based on uncommon/ unusual termed as difficult and usual/ common tasks termed as easy. In a way, every subject performed four tasks for experiment design-2, in addition to the one for experiment design-1.

Figure 3(D): Experimental design of final task phase-III (2)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Creativity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High Creativity</td>
</tr>
<tr>
<td>Dialectical Reasoning (DR)→</td>
<td>High DR</td>
</tr>
<tr>
<td>Task difficulty↓</td>
<td>High DR</td>
</tr>
<tr>
<td>Easy</td>
<td>n=38</td>
</tr>
<tr>
<td>Difficult</td>
<td>Repeated</td>
</tr>
</tbody>
</table>

Methods & Procedures:

Phase- I: Pilot Study

Since these were three phases of the study, the description of method and procedures are given phase wise.

Phase-I (A): The purpose of the pilot study was to select tools for Phase- III experiments. This was conducted on a sample of 95 healthy subjects of both sexes who were within the age range of 18 to 40 years. The subjects of this study were divided into four groups:
30 Ss for task-1 and task-2; 20 Ss for task-3; 20 Ss for task-4; and 25 Ss for task-5. The flow chart is in Figure 3(E) A multi-task multi group procedure was employed to achieve the objectives for pilot work.

**Figure 3(E): Phase-I (A) Flow Chart.**

**Task 1**

**T-1 A sample of 30** individual (both male and female) were asked to enlist the name of tools they are familiar. (List to be found in appendix-A).

**Task 2**

**T-2 The same sample** after one week revisited and presented with a list of 142 tools to arrange them into three categories as: (a) Frequently used, (b) Occasionally used, and (c) Do not use but they know the tool.

**Task 3**

**T-3: A sample of 20 Ss** was asked to endorse 35 tools into three responses: the most common use, the second common use and the other uses.

**Task 4**

**T-4: A sample of 20 Ss** was asked to describe the physical properties (affordances) of the selected 35 tool.

**Task 5**

**T-5: A sample of 15 Ss** rated the 35 tool in terms of frequency of use. Another 10 individuals then further rated the ten tools found most frequently used to select finally 5 most frequently used tools.
Procedure for Task-1 of Phase-I (A)

Participants were contacted individually and clearly informed about the purpose of the study. After establishing the rapport with the participant, he/she was asked to understand the general instructions including the meaning of tool, however the instructions for specific tool/task were provided, separately. When the subject was comfortable and ready for the task, he/she was asked that which tools were used commonly. They noted down the name of tools or kept speaking the names which were recorded by the experimenter. Task based study with each individual subject was, separately, done. Every effort was made to complete the job in a single sitting (of 15 minutes).

The number of tools named varied from subject to subject (from 10 to 35 tools). Finally, a total of 142 distinct and commonly used tools was identified which satisfied the definition of a tool (as in Chapter-1) from 30 subject.

Procedure for Task-2 of Phase-I (A)

All the 30 subject were asked to visit the laboratory after a week. They were asked to categorize 142 commonly used tools in three categories from a list handed over to each of them: Frequently using; occasionally using; and not using. There was no time limit for the completion of the task. After the completion of the task, participants were appreciated for their help and support.

Results showed that 114 tools were remained on this list, on the basis of frequently used or/and occasionally used, but 28 tool were such that though they know but not using those tools. After T-2, on the basis of frequency, tools were sorted out. In the end, out of 114, a total of 35 tools were thus identified. These tools were such which are at least used by 50 percent of the sample either frequently or occasionally.
Table 3.1: Depicts the categories of tool uses.

<table>
<thead>
<tr>
<th>Category of tool uses</th>
<th>Identified tools</th>
</tr>
</thead>
</table>
| I. Tools used frequently by 20 Ss among 30. | **Total 3** tools were identified  
Tooth-brush, Comb and Razor |
| II. Tools used frequently or occasionally by 20 Ss among 30. | **Total 3** tools were identified  
Scissor, Knife and Blade |
| III. Tools used frequently or occasionally by 15 Ss among 30. | **Total 12** tools were identified e.g.  
Hammer, spoon, mobile, calculator, pen, nail-cutter, ball, lock’s key, watch, fork, scale/ruler and T.V. remote |
| IV. Tools used occasionally by 15 Ss among 30. | **Total 17** tools were identified e.g.  
Camera, stapler, screwdriver, press, earphone, wiper, matchstick, bottle, saw, basket, mug, rope, ear-brush, pencil, tester, chalk and laptop. |

**Procedure for Task-3 of Phase-I (A)**

Third task was conducted on a subsample of 20 subjects to ask the most frequent use, second use and unique use of 35 tool (selected by 30 Ss in Task-II). This task revealed dialectical or novel uses of selected tools beside the most frequent use for the tool has been made. In Table 3.2 only second and unique uses of only five is given [complete list is in Appendix-A (i)]
Tale no 3.2: Depicts second and unique uses of selected tools.

<table>
<thead>
<tr>
<th>Tool</th>
<th>Second use</th>
<th>Unique use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toothbrush</td>
<td>Hair coloring and dusting</td>
<td>Transferring something liquid and dry powder</td>
</tr>
<tr>
<td>Comb</td>
<td>Solving untidy threads</td>
<td>Marking more than one straight line with ink</td>
</tr>
<tr>
<td>Scale</td>
<td>Cutting vegetables</td>
<td>Making decorative tree of vegetables</td>
</tr>
<tr>
<td>Knife</td>
<td>As a screwdriver</td>
<td>Making wooden spoon</td>
</tr>
<tr>
<td>Razor</td>
<td>Cutting cloths</td>
<td>Cleaning woolen cloths</td>
</tr>
</tbody>
</table>

Procedure for Task-4 of Phase-I (A)

To have an idea that what triggers the second and novel uses of common tools other than the use for which the tool is made, a sample of age -sex matched 20 Ss was used. The Ss were handed over a list of 35 tools that make them (the properties) to use those tools in 20 minutes session. A sample of affordances presented by the Ss is given in Table 3.3 [complete list is in Appendix-A (ii)]

Table 3.3: Shows the affordances in human used tool.

<table>
<thead>
<tr>
<th>Tool</th>
<th>Affordance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Toothbrush</td>
<td>Light, flexible, long and thin</td>
</tr>
<tr>
<td>2. Comb</td>
<td>Spines, thin, light and easy to carry</td>
</tr>
<tr>
<td>3. Scale</td>
<td>Long, light, easy to carry and use</td>
</tr>
<tr>
<td>4. Razor</td>
<td>Light weight, easy to handle and carry, sharp in use etc.</td>
</tr>
<tr>
<td>5. Knife</td>
<td>Long, light weight, pointed, sharp</td>
</tr>
</tbody>
</table>
**Procedure for Task-5 of Phase-I (A)**

In order to devise the problem for creative use of tools on the basis of tools perceived by Ss in Task-3 and Task-4, two sequential samples of 15 and 10 Ss were used. The 15 subjects were asked to rank 35 tools in terms of the frequency of use in day today life. From their responses 10 highly rated tools were short listed (Toothbrush, Knife, Blade, spoon, mobile, Comb, Scale, Razor, pen, and nail-cutter). The list of 10 tool was handed over again rank these tools to a sample of 10 subjects. Finally, five tool (Toothbrush, Knife, Comb, Scale, and Razor) were selected.

The Phase ended with the development of five tool use problems (with the help of 5 tool and others material). The five tool were found to be rich in affordance, used frequently and wider in scope of unique uses, guided to frame problems/ tool-use task.

1. A task with open solution based on the judgment of the subject.
2. Four task with fix solution as required by the experimenter- two were easy while two were unusual/ difficult.

**Phase-I (B):** The purpose of the part- B of phase- I was moderate the dialectical reasoning scale by translation and cultural adaptation. For dialectical reasoning scale, four vignettes from casual attribution task made by Blanchard-Fields (1996) were adopted and its Indian adaptation was prepared. In each vignette one or more character performs the action, and negative outcomes are found in their result.

According to the present research purpose, teen age and older adult vignettes were dropped to select four out of these eight vignettes. These four vignettes represent categories as under: 'young adult & middle aged' in the context of work and family (Appendix-D).

**Process of moderation & translation:** First of all, Blanchard-fields' (1996) causal attribution task which were fit according to the sample of young adults or middle age, were chosen. Then the four vignettes were translated into Hindi from English with the help of five experts. On the basis of the endorsement the best ones were chosen and then administered on an age matched sample of 30 Ss. Three judges conducted the scoring who agreed on the conceptual
definition of dialectical reasoning. The inter-judge reliability on 4 vignettes was .93, .88, .92 and .95, respectively.

Phase - II Final Study:

After task selection (tools) and standardization of dialectical reasoning scale in phase-I, final study in Phase- II was conducted. A single large group of 152 Ss was administered Creativity Test (non-verbal test of creative thinking) and then dialectical reasoning scale or vice- versa.

Tools /Tasks and Materials;

- Personal data blank sheet
- Creativity test (NVTCT) by Baqer Mehdi(1985), and
- Dialectical reasoning scale

Description of the task and materials used for each measure/task has been described, separately:

(i) Personal Data Blank Sheet: This consists of information regarding the subject’s name, age, sex, educational qualification, employment designation/status, marital status and subjects’ consent certificate etc. (Appendix-B).

(ii) A test of Creativity: This test was meant to identify creative talent with tasks chosen so that they could be most easily and economically administered over a wide range of sample. This test is being extensively used in researches on creativity in all parts of the country.

Bquer Mehdi’s (1973) test of creative thinking is adapted from 'Torrance test of creative thinking’. Creative thinking tests (verbal and non-verbal) were adaptation and standardized by Mehdi (1973,1985) in India on rural and urban samples and have been comprehensively used all over India. Here, in the present research the non-verbal test of creative thinking was used.

'Non-Verbal Test of Creative Thinking (NVTCT)': It is proposed to evaluate ability of an individual to deal in a creative manner with figural content. For this purpose three type of activity are used, viz., picture-completion, picture-construction and ellipses & triangles. The total
time required for administering the test is 35 minute, in addition to the time essential to give
instructions, passing out booklets and collecting them back. (Appendix-C)

The raw scores for each item were converted into T- scores with a mean of 50 and
standard deviation of 10 and were added up to get the total score for each item. The inter-
correlations among the three activities were found to range from .303 to .477, respectively.

The retest reliabilities of the test are considerably high, ranging from .932 to .947. The
validity coefficients against the teacher ratings and the total creativity scores are reported to be
0.346, 0.329 and 0.385, respectively for elaboration, originality and the creativity scores.
Administration and scoring was done as per manual guidelines.

(iii) Dialectical reasoning scale: Four vignettes are included in dialectical reasoning
scale. Each vignette is read and followed by attribution rating scale. In the rating scale there were
three factors i.e. internal, external and interactive which influenced the final outcome.

i. Internal factor; three degree rating is done (dispositional, responsibility and blame).

ii. External factor; two degree rating is done (situational and others).

iii. Interactive factor; one degree rating (something other than the main character or
personal characteristics is responsible for the final outcome).

On the basis of completion of rating scales, a short essay was to be written at-least of two
paragraphs answering some questions (The question with vignettes can be found in the
Appendix-D). On each essay, to measure dialectical causal reasoning, content analysis was
performed. Three attribution judgments; (1) non-dialectical, (2) potentially dialectical and (3)
dialectical were assigned to the essay on a three point scale.

Scoring: In the scoring procedure of dialectical reasoning scale, the attribution rating is
first, in which degree of familiarity on every situation of participant or Ss is rated. Probable
responses vary from very low to very high. It means there is a score for very low as 1 point and
for very high as 7 point. Secondly, each essay was content analyzed and categorized as non-
dialectical essay when the subject excluded all other perspectives and considered only one while
explaining the outcome of the vignette. Two score for more than one perspective, and three score
for the last one when it was a dialectical essay, with more complex arguments and more than one
perspective.
"Three judges who agreed on the conceptual definition of dialectical reasoning conducted the scoring. Each essay was scored by two judges and discrepancies were resolved by the third judge. Essays were selected randomly for the estimating reliability."

**Procedures for Phase - II Group assignment**

As per requirements of the present study the school & college authorities were contacted and a concise description of the research such as need for study, objectives and importance for educational curriculum was given to seek subjects from their institutes. After receiving approval, all the participants were given a brief introductory presentation about the research in a classroom setting. They were informed about their rights as per APA guidelines for participation in the study. After getting their consent, the final study was on track.

Participants were contacted individually or in group and clearly informed about the purpose of the study. upon establishing the rapport with the participant, reporting to be comfortable and ready for the test, the preliminary instructions were given to subjects as recorded on the test booklet. Before the collection of data, oral and written informed consent from each subject was taken, then the personal data blank sheet was given to fill in the columns of personal information. The test administrator asked the subjects to make sure that they had understood everything about both the tests. The both (entire) tests were administered individually or in a small group which took approximately 70 to 80 minutes. The procedure followed and scoring of responses for each test have been described, separately.

**Non-Verbal Test of Creative Thinking (NVTCT):** All the Ss were put in a large-open and peaceful room. A general importance of creative thinking in relation to various requirements for successful achievement on various cognitive activities in today’s competitive life was explained to Ss. "The administrator told them that novelty, originality and creative ability play an important role in human life. All inventions are the result of human ability to think in novel and rational way which can be based on our imagination and creative thinking. On the following pages in this booklet you will find mention of some incomplete drawing which are to be used as a base for creating novel and interesting picture with the help of your imagination and creative thinking. You will be enjoying working with this activity. You have been given three activities one by one to do; each activity is separately timed for your convenience. Try to work fast as
possible on each activity. If you finish an activity before the time for it is up, do not go to next activity until you are told to do so, use your time to make your picture more elaborate. You will be given extra five minutes at the end of the completion of three activities so that if you have got any new idea in the mean time for any of the three activity or its parts you may add it in the duration of the extra time permissible to you. Attempt every task of the three activities. If you have any query, please ask me now. If you have no difficulties you can start your work quickly."

After that, the booklet was provided to each S. Then, they were asked to read the general instructions carefully presented on the starting page on the each activity of the booklet. After reading the instructions, they were asked for any query if anyone had. Each activity has different instructions provided on the top of activity in the booklet. Then, they were further asked to exercise ‘exemplars problems’ that were presented on page of the question booklet. They were again asked for any query. Ss were then asked to complete the test within the specified time limit. After the completion of the test, all the question booklets and response sheets were collected from Ss and they were thanked for their cooperation. Scoring was done with the help of guidelines in the manual.

**Dialectical Reasoning Scale:** After establishing the rapport with the participant, when the subject was comfortable and ready for the test the preliminary instructions were given to subjects." You will be given some vignettes one by one. In each vignette a situation will be given in which you will have to protect yourself, means fitting yourself in that situation and answer some questions in rating style given in the booklet. After rating the questions you will have to write an essay of at least two paragraphs long on the basis of the rating and answer of the questions. Questions are given under the vignettes in the booklet. You have to write the paragraph in the space provided under the vignettes. There is nothing like right or wrong answers. Read each question carefully and write the answers without giving second thoughts. There is no specific time allotted for this job but please take as less time as possible." After giving the instructions, the Ss were again asked for any query if anyone had. Each vignette has the same general instructions provided below of each vignettes. After understanding everything, Ss were asked to start work. Separate sheets of paper were used to present the four vignettes. 'A series of attributional rating scales followed each vignette. Ss attempted to make attributional ratings as to the degree to which internal & external factors and an arrangement of these factors}
influenced the ultimate result. Four vignettes were again presented to the participants after completing the rating scales. They were asked to take reference of their previous ratings and to write a small essay elucidating fundamental justification for their attributional ratings.' Each vignette required fifteen minute, in addition to the time necessary for instructions, passing out booklets and collecting them back. The subject was duly thanked for his/her cooperation. After the data collection was over, all the vignettes were scored.

On the bases of scoring, high or low dialectical reasoning groups were made by median split of 76 subjects each. These groups were further divided on the basis of median creativity scores to finally have four groups of 38 Ss each: High creativity & High dialectical reasoning, High creativity & low dialectical reasoning, Low creativity & High dialectical reasoning and Low creativity & Low dialectical reasoning.

**Phase - III Final Study:**

After primary testing all the Ss (N=152) were administered five tool-use task/problem individually [Figure- 3(C) & Figure- 3(D)] in 3rd phase of the study.

**Tasks and Materials;**

- Problem 1:- Making a meaningful item/common concrete noun and bolt it
- Problem 2:- Draw a square diagram
- Problem 3:- Transferring material from one bottle to another bottle
- Problem 4:- Make a Lamp Wick
- Problem 5:- Make an artificial tree

Total five task/problem were conducted in this phase with the tools and material selected in Phase- I (A)
Problem (1):- Making a meaningful item/common concrete noun and bolt it with the given material.

Material used: - Nut bolt, knife and 10 wooden block.

Instructions: - A problem is given to you in which you have to make something meaningful which can be named with the wooden blocks given to you and bolt it with nuts so that it does not dismantle.

Figure-3(F): A sample of procedure followed for administration of open solution task/problem.

Time limit for this job is 5 minute, after that, this material will be taken back from you. So, try to complete the task as fast as possible. However, if the problem cannot be first attempt in within the time limit, you may try again and so on. Your time and actions will be observed and recorded.

Problem (2):- Draw a square diagram with the given material.

Material used: - Comb, sheet of paper, ink-pot, and gloves.

Instructions: - You are given a problem in which you will have to draw a square diagram with the material given to you. Time limit for this job is 5 minutes, after that the material will be taken back from you.
Figure-3(G): A sample of procedure followed for administration of fixed solution- easy task/problem.

So, you try to complete the task as fast as possible. However, if the problem cannot be completed in the first attempt within the time limit, you may try again and so on. Your time and actions will be observed and recorded.

Problem (3):- Transferring material from one bottle to another bottle with the given material.

Material used: - Tooth brush, one bottle filled with dry powder and one empty bottle.

Figure-3(H): A sample of procedure followed for administration of fixed solution- easy task/problem.
Instructions: - You will have to transfer dry powder from one bottle to another bottle. Use of hands is not allowed. Time limit for this job is 5 minutes, after that the material will be taken back from you. So, try to complete the task as fast as possible. However, if the problem cannot be completed in the first attempt within the time limit, you may try again and so on. Your time and actions will be observed and recorded.

Problem (4):- Make a Lamp Wick with the given material.

Material used: - Cloth, razor, and lamp.

Instructions: - You are given a problem to make a wick of lamp with the given material. Time limit for this job is 5 minutes, after that the material will be taken back from you. So, you try to complete the task as fast as possible.

Figure-3(I): A sample of procedure followed for administration of fixed solution- difficult task/problem.

However, if the problem cannot be completed in the first attempt within the time limit, you may try again and so on. Your time and actions will be observed and recorded.
Problem (5):- Make an artificial tree with the given material.

Material used:- A foot scale, box, soil, cucumber/bottle gourd.

Instructions: - You are given some material which you will have to use to make a tree. Time limit for this task is 5 minutes, then after the material will be taken back from you. So, try to complete the task as fast as possible.

Figure-3(J): A sample of procedure followed for administration of fixed solution- difficult task/problem.

However, if the problem cannot be completed in the first attempt within the time limit, you may try again and so on. Your time and actions will be observed and recorded.

Scoring: When the subject was using the tool to solve the problem, the time taken, number of moves, and number of attempts were noted down. After solving the problems of the experiment, the subject was asked about the tools of affordance, i.e., the features of the tool. The feedback was also taken from him about the way he solved the task/problems. Thus, number of moves, time, attempts and number of perceived affordance are the scores of the subject. The scoring pattern of all problems was same.
**Procedure for Phase - III final Study**

Before the starting of the experiment important arrangements were made by the experimenter. All the five task/problem were administered individually on each subject (N=152) which took approximately thirty to forty minute time in the 3rd phase. The order of presentation for each task was different, i.e. independently randomized for each subject for controlling/neutralizing the carry over effect. The material related to task were placed on a table in a neat, clean and peaceful room (a provisional laboratory). For a few experimental tasks, temporary arrangements were made each time. All the tasks were administered on each subject one by one. Inter-task interval was 2-3 minutes, so that experimenter can make necessary arrangements for the next task and subject takes a rest before participating in the next. When subject (already consented) was brought to the room, first of all, rapport was established with him. Then, a set of general instructions was given to the subject, “You are welcome here to become a voluntary participant. You have to participate in a number of experimental tasks with some rest pause to avoid the fatigue. These tasks are related to creative problem solving. Before starting each task, you will be given information about the task, awareness of the material etc. and some instructions. You have to use the provided material to solve each problem. This work is time bound. You will have to complete the task in the time assigned. Instructions and time limit is mentioned on the problem card given to you. You have to follow these instructions carefully. There is no right or wrong method of task completion; it is only related to your way of thinking. All the information collected from you will be kept secret and will be used for research purpose only. Each task is different and unique from another. So you won’t get bore, rather you will enjoy doing these tasks and every task /problem is interesting. You are here to co-operate in an informative endeavor and the success of the study heavily depends on you. I am sure you will cooperate and involve fully. So, complete the task as soon as possible.” After the instructions the subject was asked if he needs clarification about anything, he may ask. After that actual work started. General instructions were given to the subject. Specific tool use task problem and related material was given to the subject one by one. When everything was cleared to the subject he was asked to start the work.

In order to know the way of thinking and affordance subject's detailed protocol and feedback was obtained after the task was complete and side by side all of the subject was put in a condition in loud protocol/speaking. Holding, sequences, steps and view of handling was by
observed. All the information of the subjects was recorded, moves, attempts, perceived affordances & time to solve etc. The complete feedback was noted down by the experimenter in detail.

The subject was given five problems one by one using the same procedure on the same subject. Tool use task problem and the related material were different each and every time. Subject solved the problems one by one carefully talking about the procedure he was using to solve. It took approximately 30 to 45 minutes to complete the work. Five minutes were given for each problem. These five tool use task problem were conducted in individual settings on 152 Ss one by one using the same procedure.

In the end, a formal note of thanks was given to the subjects for cooperation in the experiments. The procedure described as above of all the tasks/experiments was followed for each subject. The only difference was the order of tasks, which was independently randomized for each subject. After completing the experiments, the data records were tabulated in the form of a master chart to derive the scores or measures for analysis.

**Overall Scoring/Measures:**

As evident from design and procedure described above, the study yielded several measures. The list of all the measures incorporated in the present research follows:–

**Scaling of the tool use task: Dependent measures:**

1. The time taken in seconds to solve the problem.
2. The number of attempts within prescribed time limit, i.e., again reorganizing afresh after some moves have been advanced.
3. The total number of moves, i.e., a discrete movement with the tool or other material within the time limit.
4. The number of affordances (physical properties) of the tool perceived after solving the problem.
**Statistical Analysis:**

After scoring of the responses and data entry, the data were subjected to statistical analyses. First of all, the obtained scores were run for the testing of assumptions for Univariate analysis.

The data were analyzed for (1) Descriptive statistics, and (2) Inferential statistics.

(1) Descriptive statistics, mean and standard deviation, were employed to know the nature of the distribution of the variables taken up for the study.

(2) Performances on the tests were subjected to two type of inferential statistics first, two way (2x2) analysis of variance for scores from with open solution-subjective judgmental task/problem and second, three factor (2x2x2) ANOVAs, repeated measure on third factor for all scores of fix solution-easy and difficult task/problems. The scores on the four dependent variables were aggregated of two easy problems for easy level and similarly for two difficult (unusual) problems for difficult level of task. To examine the nature of these relationship graphical representations were also portrayed. The description of results is presented in the next chapter.