METHODOLOGY
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 453 participants (25 - pilot study plus 428 - final study) was employed for the present study. Before the final administration, a pilot study was carried out on a small group of 25 students for task selection and task standardization. The final study followed a three stage sampling. At first stage, Jalota’s Group test of General Mental ability was administered to a large sample (N = 428) as inclusion criterion variable. Ss with high and low intelligence were excluded. At the second stage, subjects within the average range of General Ability scores and among those who were available (i.e. consented) for all (six) tasks (N=296), were selected. The remaining subjects who didn’t fall within the inclusion criteria (N = 110) and who were absent or did not consented across testing sessions (N=22), were excluded. Included sample consisted of Ss of both sex (M = 200, F = 96) between age range of 12 to 15 years (M = 14.07 & SD = 0.91) who voluntarily agree to participate in the study. All the Ss were students of senior secondary classes. On the third stage, those subjects (N = 70) who exhibited a general tendency to make more errors in the form of high switch costs on WCST, Numerical and Anagram tasks were selected through a four step sorting criteria (see procedure).

Design
A tri-phasic multi-task, repeated measure design was employed to achieve the objectives of the study. A flow chart of design employed in the present study is presented below.

❖ Pilot Study task selection and standardization
❖ Phase - I selecting subjects with average mental ability from the initial sample (stanine scale range of 3 to 7 - scores from 22 to 77)
❖ Phase - II testing on selected sample on six tasks (DV's & correlates) and selecting subjects with high switch cost
❖ Phase - III interventions and post testing on DV's in two equivalent high switch cost groups
### Fig. 2.1 Experimental design of the study

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<th>Phase I</th>
<th>Single Large Group (N = 428)</th>
<th>Jalota’s General Mental Ability Test</th>
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<td>Task 1</td>
<td>Large sample (N = 296)</td>
<td>Task-switching in categorization/Classification tasks (WCST)</td>
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<td>Task 2</td>
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<td>Mobility task (Flexibility of Attention task)</td>
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<td>Task-switching in Anagram task</td>
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<td>Task 6</td>
<td>Large sample (N = 296)</td>
<td>Task switching in Numerical task</td>
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<th>Phase II</th>
<th>Pre – Post two equivalent group design</th>
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<td><strong>Intervention Group</strong></td>
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<td>E - Group (N = 35)</td>
<td>X₁ X₂ X₃</td>
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<td>I - Group (N = 35)</td>
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Where, X₁ = WCST  \( Oₑ \) = Explicit intervention, training/practice on similar tasks
X₂ = Anagram Task \( Oᵢ \) = Implicit intervention, background color cue
X₃ = Numerical Task subconcious priming on similar tasks
**Procedure:**

**Pilot Study**

The purpose of the pilot study was to try out for the selection of some experimental tasks, selection of material/items for these tasks, exposure time, set of instructions, procedure to be followed and responses to be recorded. This was administered separately on a sample of 25 healthy subjects who were within the age range of 12 to 15 years. The subjects of this study were screened by Jalota's group test of general mental ability. This sample was limited only for achieving our preferred aim of task selection and standardization; and was not used in the final study. Initially two tasks, i.e. Numerical problem solving and Anagram solution were prepared and standardized for the final study. Both the tasks were structured in a rule based (concept learning as rules for discriminating as categories of objects) manner.

This pre-examination of tasks guided to outline important information for task development. Two blocks of numerical problems with a total of 20 problems (10 each) following the rule of addition and subtraction was included. The anagram task involved only words of four letters and two blocks of 30 problems (15 each). Use of anagrams of limited letters (4 letters here), was based on the observation that with larger letters (such as 5 or 6), Ss had difficulty in solving larger anagrams, as the aim of the study was to create a task that increases the probability of 'set formation' and not the difficulty level. An increase in the number of trials in this task was based on the observation that Ss had difficulty in the formation of set and its maintenance. So it appeared that more number of trials led to more practice as well as learning of rule, hence, greater was the probability of set formation and maintenance. The time specified for the presentation of both tasks (i.e. 30 seconds for each numerical problem and 35 seconds for each anagram problem) was based on average time taken by Ss of the pilot study. An additional time (10 seconds) was allotted to Ss if they failed to solve a problem under specified time in both tasks. Font size selected for the presentation of problems was decided so that it was easily readable to Ss. All the problems were presented in PPT slide show with 'no transition' animations and with a medium transition speed. The same procedure for presentation of problems was followed for all the problems in final study also. Above stated observations
obtained from this pre-study were considered as a base for the development and execution of tasks (numerical and anagram) for the final study.

Final Study

As per requirements of present study, in the form of age group, contextual importance of research and objectives of study, the school authority was contacted and a concise description of the present research such as need for study, objectives and importance for educational curriculum at current milieu was provided. After receiving approval from the school’s principal, 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 experiment. After getting their consent, the final study was on track.

After task selection and standardization, final study, which was divided into three main phases, was initiated. In Phase I, a single large group was administered Jalota’s Group Test of General Mental Ability and those subjects, whose total scores fall within the stanine scale range of 3 to 7 i.e. from the score of 21 to 77 (varied for different classes) were selected and remained were excluded. After primary screening all the Ss were administered 6 tasks individually (Fig. 2.1) in 2nd phase of the study.

All the six tasks/measures were administered individually on each subject which took approximately seventy to ninety minute time in the 2nd phase. The order of presentation for each task was different, i.e. independently randomized for each subject for balancing/neutralizing the carry over effect. This phase consisted of six tasks. Task’s apparatus or materials were placed on a table in a neat, clean and peaceful room (a makeshift laboratory). For a few experimental tasks, temporary arrangements were made each time. All the tasks were administered on each S one by one. Inter-task interval was 2-3 minutes, so that experimenter can make necessary arrangements for the next task and S takes a rest before participating in the next. When S (already consented) was brought to the room, first of all, rapport was established with him. General information’s regarding his name, age and education were collected. 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 perceptual ability/skills and general problem solving. Before starting each task, you will be given information about the task, familiarity of the apparatus etc. and some
instructions. You have to follow these instructions carefully. There is nothing to worry about. All the information collected from you will be kept secret and will be used for research purpose only. Each task is different from another. So you won’t get bore, rather you will enjoy doing these tasks. You are here to co-operate in an educational endeavor and the success of the study heavily depends on you. I am sure you will bear with us.”

Due to absence over testing sessions, a total data of 296 Ss was available. After administering all the tasks, those Ss who had high switch costs were selected for 3rd phase from the available subjects. Such Ss were selected through the following four step sorting criteria-

**Step 1**
Those Ss who have completed at least four (or more) categories on WCST were selected (N = 222)

**Step 2**
Those Ss who were sorted at 1st step (N = 222) and were above P50 (Median split), i.e. who have more than 15 percent perseverative errors were selected (N = 111)

**Step 3**
Those Ss who were sorted at 2nd step, and have completed at least one category/block each on Numerical task and Anagram task were further selected (N = 89)

**Step 4**
Among those selected at third step, those Ss who made more perseverative errors on both Numerical and Anagram solution tasks were selected (N = 70)

This helped to find out such Ss, who pursued rule dependent learning, set maintenance and set-switching by completing more categories on verbal tasks such as numerical and anagram task, as
well as on non-verbal tasks such as WCST and also exhibited a general tendency to make more switch costs on similar tasks. In this way, those Ss who didn’t reveal rule based learning, set formation and set-switching, in terms of categories completed - were screened out by the sorting criteria. Obviously, set-switching depends first on earlier set formation and then switching after finding the earlier as irrelevant.

3rd Phase: This phase was divided into two stages:

I. Intervention stage: A time gap of 7 to 8 days was maintained between the 2nd phase and 3rd phase of the study. During this phase, a total of 70 subjects (Ss) having high switch costs (who were selected through four step sorting criteria) were randomly divided into two groups (35 each) through a lottery method. Group 1 was administered explicit intervention on Concept formation test, numerical task and anagram task. Group 2 was administered implicit intervention on the same tasks, i.e. sub conscious cues in the form of training on similar tasks (review has suggested a clear transfer and split over – Table 2.4 & 2.5). The tasks (numerical and anagram) were different from the one which were used in the 2nd phase of the study with inclusion of new problems and with different rule based learning. Both groups (group 1 & group 2) in this phase were given the same tasks, though; they differ in the manner of background color (group 1 – uniform white background, group 2 – variable red, green and dark yellow backgrounds) used for their presentation. Subjects of both groups were further divided into five equal sub-groups having 7 subjects each for the sake of handling of time schedule. These five sub-groups were intervened and tested for Second stage, i.e. post-intervention, in such a manner that Ss were tested for post intervention on the next consecutive day (roughly after 24 hours of the intervention). The same procedure was followed for all the Ss in both groups.

II. Post-Intervention stage: After the succession of Stage 1 of phase III, Stage 2 (post-intervention) was on track. At this stage the effectiveness of the intervention strategies was analyzed in both groups on WCST, numerical task and anagram task (criterion
tasks). The tasks that were used in the 2nd phase of the study were used again. The tasks of 2nd phase and this phase were similar in the manner that these tasks were based on the principle of rule based learning, but different with placing of new problems and with changed order of rule based learning. A time gap of one day (approximately 24 hours) was maintained between intervention and post-intervention stage. At this phase, all the Ss were examined on the selected measures individually, which took about thirty to forty minutes.

**TASKS AND MATERIALS**

The selection of tools was governed by the contemplation of their availability, suitability to the sample, reliability and validity. Keeping in view these considerations, the tests/tasks selected for data collection in different phases of study, have been described, separately, in four sub-sections. While the procedure followed, recording and scoring of responses have been described in separate section further.

1). Task for First phase
2). Tasks for Second phase
3). Tasks for Third phase's 1st stage, i.e. Intervention
   3a). For Explicit Intervention
   3b). For Implicit Intervention
4.) Tasks for Third phase's 2nd stage, i.e. Post-intervention
   4a). For Explicit group
   4b). For Implicit group

Description of the task and materials used for each measure/task has been described, separately.
1). Task used for 1st phase

Group Test of general Mental Ability: Revision (72) – Dr. S Jalota's test of General mental ability (R 72) is a standardized test for measuring the intelligence. It consists of 100 items, divided into five sub-categories as (i) Vocabulary – 10 similar plus 10 opposite, (ii) Classification – 20 items, (iii) Number series – 20 items, (iv) Analogies – 20 items, and (v) Reasoning – 10 best answer plus 10 reasoning items. All the items were mixed and arranged in an empirically determined order of increasing difficulty. The reliability coefficient of the test calculated by the findings of the correlation between odd-even scores through Spearman-Brown formula varied from 0.783 to 0.979 for different groups/classes. Oblique rotation revealed three factors as verbal, numerical and reasoning factors. The test is equally suitable for the assessment of undergraduate classes (age between 12 to 18 years) in the colleges and universities of the Hindi speaking area. Total time given for test administration was 20 minutes.

2.) Tasks for 2nd Phase

Total six tasks were conducted in this phase-
(2.1) Categorization/Classification task (Wisconsin Card Sorting Test)
(2.2) Cognitive Interference task (Color-Word Stroop Test)
(2.3) Numerical Problem solving task
(2.4) Anagram solution task
(2.5) Performance task measuring Lability (Critical Flicker Fusion Frequency - CFFF) and,
(2.6) Performance task measuring Mobility (Inspection Test – Flexibility of Attention)

2.1) Wisconsin Card Sorting Test (WCST) – Revised and Expanded (Heaton et al., 1993)
Setting and Test Material – The usual form (Heaton, 1981; Heaton et al., 1993) of WCST comprises of four stimulus cards and 128 response cards with geometric figures that differ in three ways of perceptual measurements (i.e. Color, form, and number). The task demanded participants to uncover the correct categorization/sorting rule by trial and error and evaluations of feedback from examiner. When the subject finds the correct sorting rule, he is required not only to maintain the correct sorting rule across changing conditions, but to ignore the other, now unrelated stimulus condition also. The categorizing/sorting principle changes after every ten
Figure 3.1 A sample card used in Wisconsin Card Sorting Test
consecutive correct responses without warning and demands a flexible shift in the set. There is no time limit for the completion of the test and it requires either sorting until the last card or a maximum of six correct categories have been completed. Experimenter and S sat in the opposite direction on a table. Stimulus cards and response cards were put in front of the S on the table. Experimenter hides the WCST record booklet in such a manner that S can’t see his response recordings (see Figure 3.1 a sample card used in WCST).

2.2) Cognitive Interference Task: Color-Word Stroop Test

The interference caused by two competing tasks has been studied extensively using the Stroop paradigm. Specifically, this paradigm has been partly used to examine the modulation of interference caused by the unintentional activation of the irrelevant to the current trial task-set. In studies related to Stroop test, researchers observed that it was more difficult to switch to the dominant task than the other way around (Allport, Styles, & Hsieh, 1994, Allport & Wylie, 2000).

Setting and Test material – Stroop Neuropsychological Screening Test – SNST (Trennery et al. 1989) was used for recognizing cognitive interference among subjects. Test material consists of Form C Stimulus Sheet, Form C-W Stimulus Sheet and SNST Record Form. The Form C Stimulus Sheet consists of 112 color names (red, green, blue, yellow*) arranged in 4 columns of 28 names. The names were printed in one of four different colors of ink (red, green, blue, yellow), but no name was printed in its matching color (e.g., the name red was never printed in red ink). The Form C-W Stimulus Sheet was the same as the Form C Stimulus Sheet, except for the order of the color name. The Form C and Form C-W Stimulus Sheets were used in the administration of the Color and Color-Word tasks, respectively. The SNST Record Form was a four page booklet that was used to record S’s demographic information, clinical data, and responses for the Color and Color-Word Tasks, and SNST scores. In the record form ‘Tan’ color responses were replaced by ‘yellow’ color responses. Experimenter (E) with record form and S with both the Forms (Color- Form and Color-Word Form) took seats on opposite sides of the table [see Figure 3.2 (a & b) Form C and Form C-W Stimulus sheets used in cognitive interference task]
*Color ‘Tan’ (as in SNST) was replaced with ‘Yellow’ color because it was found that the Indian population is not very much familiarized with ‘Tan’ color.

2.3) Numerical Problem Solving Task:
The findings from the earlier studies of task switching (Jersild, 1927; Spector & Biederman, 1976) have motivated us to examine the phenomenon of set switching between arithmetic tasks. With reference to previous findings and from observations of the pilot study, this task involved solving simple arithmetic problems with alternative numerical combination rules like addition and subtraction.

**Setting and Test Material** – Material for this task was prepared with the help of Microsoft Office 2007 - Power Point Presentation (PPT) in a SONY laptop ‘Windows 7’ operating system with 15.6” display. A total of 20 slides (Aerial Rounded MT Bold with a font of 100) were prepared. This task involved simple mathematical ‘number series’ problems which were structured in a rule based (or defining feature based) manner. Two blocks of problem were formed which consisted of 20 problems (10 each). First block involved first ten problems (1 to 10) which were based on the rule of ‘addition’ and second block involved remaining 10 problems which were based on the rule of ‘subtraction’ (see Appendix-III).

The task demanded participants to uncover the correct sorting rule by trial and error and evaluations from examiner’s feedback. When the subject finds the correct sorting rule, he is required not only to maintain the correct sorting rule across changing conditions, but to ignore the other, now unrelated stimulus condition also. The sorting/learned principle changed after first ten problems or completion of one block, without warning and demands a flexible shift in the set by responding according to the new sorting rule. Experimenter (E) and S took seats on opposite sides of the table. The laptop’s display was adjusted for convenient viewing.

2.4) Anagram Solution Task
With an anagram problem, a letter string is presented and the task is to find a word using all of the letters in the string and only those letters. The solution to anagrams occupy two stages, first is rearrangement of letters and then the matching of the rearranged letters with a word retrieved from memory (e.g., Bourne & Dominowski, 1972; Jablonski & Miieller, 1972; LeMay, 1972; Safren, 1962; Schuberth, Spoehr, & Haertel, 1979; Warren & Thomson, 1969).
### FORM C STIMULUS SHEET

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Figure 3.2 (a) Form C Stimulus Sheet used in Cognitive Interference Task
**FORM C-W STIMULUS SHEET**

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*Figure 3.2 (b) Form C-W Stimulus Sheet used in Cognitive Interference Task*
Setting and Test Material: Material for this task was prepared with the help of Microsoft Office 2007 - Power Point Presentation (PPT) in a SONY laptop ‘Windows 7’ operating system with 15.6” display. A total of 30 slides (Aerial Rounded MT Bold with a font of 200) were prepared. This task entails letter strings of four letters. Two blocks of problem were formed which consisted of 30 problems (based on observation of pilot study’s findings). First block involved first fifteen problems (1 to 15) and second block involves remaining 15 problems. Both the blocks were prepared in a rule based (or defining feature based) manner. In first block, all the four letters of a meaningful word (in meaningful sense – all the letters will be arranged in the order of 1234) were placed in a reversed order i.e. 4321. For example, if the meaningful word is ‘KING’, then the new arrangement (anagram) according to the present rule will be ‘GINK’. In the second block, the rule followed for making anagrams from meaningful words was in the order of – 2341 i.e. first letter got fourth position, second letter got first position, third letter got 2\text{nd} position and fourth letter got 3\text{rd} position. For example, if the meaningful word is ‘GIRL’, then its anagram according to this rule will be ‘IRLG’. A precaution was taken to the use of easy, common usage and meaningful words/nouns of four letters only. It was also limited only to use such anagrams that have only a single meaning (see Appendix-IV).

The task demanded participants to uncover the correct sorting rule by trial and error and evaluations from examiner’s feedback. When the subject picks the correct sorting rule, he is required not only to maintain the correct sorting rule across changing conditions, but to ignore the other, now unrelated stimulus condition also. The sorting/learned principle changed after first fifteen problems or completion of one block, without warning and demands a flexible shift in the set by responding according to the new sorting rule. Experimenter (E) and S took seats on opposite sides of the table. The laptop’s display was adjusted for convenient viewing.

2.5) Critical Flicker Fusion Frequency (CFFF)

Critical Flicker Fusion (CFF), which appears to have a genetic component (Murawski, 1960), is a type of threshold which refers to the frequency of a blinking light stimulus at which the perception of flicker changes to the perception of a steady light. For decades the CFF has been used in studies on the physiology of vision. A number of studies had reported this parameter as a determinant of the lability of the Nervous System (NS) (Ravich-Shcherbo and Schwartz, 1959;

**Setting and Apparatus** - The digital flicker fusion apparatus was used. This is an electronic device standardized by 'Medicaid Systems, Chandigarh'. It is the most suitable device for producing precise and reliable flicker, and has many advantages like: absence of noise and vibrations, ease of operation, the possibility of producing square wave light stimuli etc.

For the operation of the instrument, firstly the flicker fusion frequency (FFF) control knob which is on the right side of the instrument was kept at the minimum position i.e. anticlockwise direction. Then instrument was switched from ON/OFF switch. Light source started flickering and its frequency is displayed on the LCD panel meter. Intensity of light source was selected from brightness % selector switch (100, 75, 50 and 25%), which is normally kept at 100 percent. Red color of the light was selected from Red/Green selector switch. Eyepiece hood was inserted in the housing provided on the front panel of the instrument. S was seated in a chair and instrument was placed on a table in front of the subject. The stand was adjusted for convenient viewing.

**2.6) Inspection Test – A Test of Flexibility of Attention/Mobility**

Inspection implies scanning and searching in the visual field with a focus on the target and comparing it with other figures in the field. It involves the flexibility of attention. Those who shall be having greater flexibility will make fewer errors and will likely to detect the target. It is linked to the mobility of nervous processes (Mangan, 1967a, b, 1978; Strelau, 1977).

**Setting and Materials** - Material for this task was prepared with the help of Microsoft Office 2007 - Power Point Presentation (PPT) in a SONY laptop 'Windows 7' operating system with 15.6” display. A total of 120 slides were prepared. Six circles (2 rows with 3 each) of red color with white background were shaped on 60 slides. And remaining 60 slides were blank with white background. All slides were arranged in such a manner that each slide with six red circles was followed by a blank slide. Blank slide was added with a rationale to avoid the carryover effect of previous slide's shape. Some slides contained all the six figures (circles) of equal size. But on others, one of the six circles was of smaller dimension than the rest of the five circles. The diameter of the small and big circle was 3.2 cm. and 3.5 cm., respectively [see Figure 3.3 (a & b)]
Inspection Test: Flexibility of Attention (Mobility)

Fig. 3.3 (a) A Sample of Critical Signal used in Inspection task

Fig. 3.3 (b) A Sample of Non-Critical Signal used in Inspection task
3). Tasks for 3rd Phase i.e. Intervention

As per the stated objective of the present study in the review of literature, i.e. “to see the effectiveness of some selected moderating variables (explicit-implicit) as strategies among those having difficulty in set switching (high switch costs) in relation to correlates”, those Ss who exhibited a general tendency of making more switch costs on verbal and non-verbal tasks (i.e. WCST, Numerical and Anagram task), were selected for intervention to achieve the desired objective. Total Ss (N=70) in this phase were randomly divided into two equal groups (35 each). The one group obtained explicit intervention on selected tasks (i.e. Concept formation task, numerical task and anagram task) and the second group received intervention on the same tasks but with different form of intervention i.e. implicit. Tasks of this phase, i.e. Concept formation task, numerical task and anagram task were presented in Appendix-V, Appendix-VI and Appendix-VII, respectively.

3A) 1st Group (Explicit Intervention)

3A.1) Concept Formation Test - This test was developed by Dwivedi (1976). It uses conjunctive (a type of concepts) categories. These categories are defined by the joint presence of several attributes: anything that has the properties of x, y, z is an A. There are 36 problems to be solved by conceptualization. Each problem consists of two sets (pairs) of items, (simultaneous presentation) which contain symbolic characteristics (designated in letters and numbers) representative of some object. Such attributes are common in pairs, while others are not. The item-objects include 4, 9, or 16 attributes as whole, having 2, 3, or 4 in common. Each type of pair appears at a regular interval of nine, and specifically with the same common characteristics, at an interval of 18.

For the validation of fitness to intervention process, the original test (see Appendix V) was computerized by developing all the 36 problems with the help of Microsoft Office 2007-Power Point Presentation (PPT) on a SONY laptop. A total of 36 slides, one problem on each (Times
New Roman plus Bold with a font of 80) with white background were prepared [see Figure 3.4 (a) A sample of Concept Formation test problem used for explicit group at intervention stage].

3A.2) Numerical problem solving task -
In intervention stage, we seek to emphasize on tasks that entail rule based learning. So, a new arithmetic task was prepared. This task was similar to the numerical task earlier used in 2nd phase of the study in the sense that it followed the principle of rule guided learning, but different in the manner that it required solving arithmetic problems of moderate difficulty with alternative numerical combination rules like division and multiplication.

Setting and Test Material – Material for this task was prepared with the help of Microsoft Office 2007 - Power Point Presentation (PPT) on a SONY laptop. A total of 20 slide (Aerial Rounded MT Bold with a font of 100) with white background [see Figure 3.5 (a) a sample of numerical problem used for explicit group at intervention stage). This task involves simple mathematical ‘number series’ problems which were guided in a rule based (or defining feature based) manner. Two blocks of problem were formed which involve total 20 problems (10 each). First block involve first ten problems (1 to 10) which followed the rule of ‘multiplication’ and second block involve remaining 10 problems which followed the rule of ‘division’ (see Appendix VI). The task demanded participants to uncover the correct sorting rule by trial and error and evaluations from examiner’s feedback. When the subject finds the correct sorting rule, he is required not only to maintain the correct sorting rule across changing conditions, but to ignore the other, now unrelated stimulus condition also. The sorting/learned principle changed after first ten problems or completion of one block, without warning and demands a flexible shift in the set by responding according to the new sorting rule.

3A.3) Anagram Solution Task
With an aim to promote rule based learning explicitly, a new anagram task was prepared. This task was though similar to the anagram task used in 2nd phase of study as it also followed the principle of rule guided learning with four letter string problems, but with new rule based learning.
**Setting and Test Material:** Material for this task was prepared with the help of Microsoft Office 2007 - Power Point Presentation (PPT) on a SONY laptop. A total of 20 slides (Aerial Rounded MT Bold with a font of 200) with white background were prepared [see Figure 3.6 (a) A sample of Anagram problem used for explicit group at intervention stage]. This task involved words of four letter strings. Two blocks of problem were formed which involved total 20 problems (10 each). First block involved first fifteen problems (1 to 10) and second block involved remaining 10 problems. In first block, all the four letters of a meaningful word (in meaningful sense – all the letters will be arranged in the order of 1234) were misarranged e.g. in order of 3214. For example, if the meaningful word is ‘KING’, then the anagram according to the present rule will be ‘NIKG’. In the second block, the rule followed for making anagrams from meaningful words was in the order of – 1432. For example, if the meaningful word is ‘GIRL’, then its anagram according to this rule will be ‘GLRI’. A precaution was provided towards the use of easy, common usage and meaningful words/nouns of four letters only. It was also limited only to use such anagrams that have only single meaning (see Appendix-VII).

The task demanded participants to uncover the correct sorting rule by trial and error and evaluations from examiners’ feedback. When the subject finds the correct sorting rule, he is required not only to maintain the correct sorting rule across changing conditions, but to ignore the other, now unrelated stimulus condition also. The sorting/learned principle changed after first fifteen problems or completion of one block, without warning and demands a flexible shift in the set by responding according to the new sorting rule.

**3B). 2nd Group (Implicit Intervention):**

The same test material (i.e. Concept Formation Test, Numerical and Anagram solution task) instructions, and procedure, as employed in the 1st group during explicit intervention, was used for this group with slight modifications. Implicit cue (in the form of background color) was offered by a plan to adjoin the cue with problems that might be helpful in directing ‘rule based learning’. It was not revealed to the subjects but changed automatically with shift trials.

**3B.1) Concept Formation Test:** The only difference was that all the 36 problems in 1st group (explicit) were presented with white background and apart from general instructions regarding the test some additional verbal instructions were also provided, but here, the problems in each block were presented with different background colors. All 36 problems were divided in 3 equal
blocks (12 each). First twelve problems (1 to 12) were presented with ‘red’ background color, next twelve problems (13-24) were with ‘green’ background color and the remaining (25-36) problems were presented with ‘dark yellow’ background color (see Figure 3.4 (b) a sample of Concept formation Test problem used for implicit group at intervention stage).

3B.2) Numerical problem solving task: The 20 problems in 1st group were presented with white background and along with general instructions regarding the test as well as additional verbal instructions, whereas, in group 2 all the problems were presented with different background colors and without additional verbal instructions. All the 20 arithmetic problems were divided in 2 equal blocks (10 each). First ten problems (1 to 10) were presented with ‘red’ background color while the remaining ten problems (11-20) were presented with ‘green’ background color (see Figure 3.5 (b) a sample of numerical problem used for implicit group at intervention stage).

3B.3) Anagram solution task: The 20 anagram problems in explicit intervention stage were presented with white background and along with general instructions regarding the test as well as some additional verbal instructions. But, here all the problems were presented with different background colors and without additional verbal instructions. All problems were divided in 2 equal sets (10 each). First fifteen problems (1 to 10) were presented with ‘red’ background color while the remaining (11-20) problems were with ‘green’ background color (see Figure 3.6 (b) a sample of anagram problem used for implicit group at intervention phase).

4.) Tasks for 3rd Phase’s 2nd stage i.e. Post-intervention

With reference to objective of present study i.e. “to see the effectiveness of some selected moderating variables (explicit-implicit) as strategies among those having difficulty in set switching (high switch costs) in relation to correlates”, Ss of both intervention group i.e. explicit and implicit, were tested again to examine efficiency of intervention strategies through transfer of learning to other tasks with same conditions of intervention stage (i.e. explicit group with white background and implicit group with varied background colors), on same tasks of second phase but with changed rule of learning.
Fig. 3.4 (a) A sample of Concept Formation Test problem used for Explicit Group at Intervention Stage

Fig. 3.4 (b) A sample of Concept Formation Test problem used for Implicit Group at Intervention Stage
Numerical Problem solving task 3\textsuperscript{rd} Phase - Intervention stage

Fig. 3.5 (a) A sample of numerical problem used for Explicit Group at Intervention Stage

Fig. 3.5 (b) A sample of numerical problem used for Implicit Group at Intervention Stage
Anagram Task 3\textsuperscript{rd} Phase: Intervention stage

Fig. 3.6 (a) A sample of Anagram problem used for Explicit Group at Intervention Stage

Fig. 3.6 (b) A sample of Anagram problem used for Implicit Group at Intervention Stage
4A). 1st Group (Explicit)
The same tasks (WCST, Numerical problem solving task and Anagram solution task) which were used in the second phase of study, were used here with slight modifications for examining the effectiveness of intervention strategies after about 24 hours.

4A.1) WCST: At this stage, only the order/sequence of sorting the response cards was changed. The original order of sorting the cards into total six categories in WCST is C-F-N-C-F-N (Color-Form-Number-Color-Form-Number). But for the purpose of avoiding the practice effect of 2nd phase and uncovering the transfer effect of learning through intervention, the order of sorting the response cards was reversed i.e. N-F-C-N-F-C (Number-Form-Color-Number-Form-Color).

4A.2) Numerical Task: The task used here was also a rule guided learning task. This task was different from the task used in 2nd phase of study in terms of different/new order of rule presentation (see Appendix VIII). In 2nd phase of study, two sets with equal number of problems followed by rule guided learning in the order of ‘addition and subtraction’ were administered to Ss. But for the purpose of avoiding the practice effect of 2nd phase and checking the learning of transfer effects through intervention, the rule was reversed i.e. first block of problem was based on the rule of subtraction and second block was based on the rule of addition [see Figure 3.8 (a) a sample of numerical problem used for explicit group at post-intervention stage].

4A.3) Anagram task: This task was also a ‘rule based’ condition. It was also different from the anagram task of 2nd phase in a way of different/new order of rule presentation (see Appendix-IX). The new order of rule guided learning was 4-3-2-1 and 1-3-2-4 for 1st and 2nd block, respectively (see Figure 3.9 (a) a sample of anagram problem used for explicit group at post-intervention stage).

4B). 2nd Group (Implicit)
The same task (i.e. WCST, Numerical problem solving task and Anagram solution task) with same procedure and same set of conditions were used as for 1st group in this stage (post-intervention) with slight modifications.

All the tasks in 1st group of post-intervention stage were presented with a uniform white background color but the selected tasks for this group were administered with different background colors, individually.
4B.1) WCST: Along with all stimulus cards and response cards, sheets of various colors (red, green and dark yellow) were used with a purpose of providing similar conditions of intervention phase in form of background color, implicitly. Stimulus cards were placed on colored sheets (see Figure 3.7 a sample of colored sheet used for implicit group at post-intervention stage).

4B.2) Numerical Task, and

4B.3) Anagram Task

Both the tasks (Numerical & Anagram) for 2nd group in this stage were presented with different background colors, individually for a block of problems and changed without warning (see Figure 3.8 (b) and 3.9 (b) a sample of numerical and anagram problem used for implicit group at post-intervention stage, respectively).

PROCEDURE

In general understanding, a procedure is a way of describing how the experiment/task was executed. As the description about the test material/tools used in the study have been presented earlier, the procedure followed, recording and scoring of responses for each measure/task have been described separately.

1). Procedure for 1st phase (Group test of General Mental Ability test): This test was administered in group settings. A total of six groups (varied in number from 65 to 75) were formed to administer this test in separate sessions on a total sample of N=418. All the Ss of each group were put in a spacious and peaceful room. A general importance of mental ability in relation to various requirements for successful achievement on various general as well as cognitive measures/tasks in today’s competitive life was explained to Ss. After that, one question booklet and one response sheet were provided to each S. Then they were asked to read the general instructions carefully presented on the first page of the question booklet. After reading the instructions, they were asked for any query if anyone had. Then, they were further inquired to exercise ‘exemplars problems’ (total 14) that were presented on 2nd page of the question booklet. After they were again asked for query, if any. Then, Ss were 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 them and they were thanked for their cooperation. The same
Figure 3.7 A sample of procedure followed for administration of WCST task (Implicit group) at 3rd Phase Post-intervention Stage
Fig. 3.8 (a) A sample of numerical problem used for Explicit Group at Post-intervention stage

Fig. 3.8 (b) A sample of numerical problem used for Implicit Group at Post-intervention stage
Fig. 3.9 (a) A sample of Anagram problem used for Explicit Group at Post-intervention stage

Fig. 3.9 (b) A sample of Anagram problem used for Implicit Group at Post-intervention stage
procedure was followed for all the six groups. The testing was endorsed by the school authorities and done in the school premises.

Scoring: The general key was used for finding out the examinee's score of general mental abilities or intelligence from his answers given to the items on the test. On the top row, the pages 1 to 5 refer to the said page in the test booklet. In some cells of each key, the top page row of the key has its lower line to be cut through, to help anchoring of the given key with the corresponding row of the answer sheet. In the key, there were two columns for each page. One shows the correct answer for the corresponding series of question items indicated on the answer sheet. To convert the key into scoring stencil the column of the key under each page has blank cells. This column has to be cut out carefully from the top of the bottom row.

After scoring the answer column for the first page (of the booklet) the numbers of wrong and unattempted item were counted and were subtracted from 20 (the number of items on each page). Obtained score was written on the bottom of the sheet. The same procedure was followed for the rest two sheets and at last the total numbers of all the three sheets were added to get the findings. General ability scores were considered for the screening of subjects for the final study. Those Ss whose scores were within the range of 22 to 77 or stanine scale range of 3 to 7, according to test manual, were selected. It included a sample of 314 participants.

2). Procedure for 2\textsuperscript{nd} phase: In this phase, a total of six tasks were conducted.

All these tasks were conducted individually for each subject. The procedure followed, recording and scoring for each task/measure is as-

2.1) WCST

Standardized procedure for test administration, recording of the response and scoring was followed (Appendix I). Percentage of various scoring criteria such as error, perseverative responses, perseverative errors, non-perseverative errors and conceptual level response, were accounted for analysis in present study, because percentage reflects the density or concentration of scores in relation to overall test performance. Beside, these scoring criteria, other criteria of WCST used in the study were - Number of categories completed, Trials to complete first category, and Failure to maintain set.
2.2) Cognitive Interference task:

Standardized procedure for Color Stroop task administration was followed (Appendix II). Scoring of responses on this task was completed by using the formula for calculating the Color-Word scores. Hence, higher scores were considered as indicative of less cognitive interference and vice-versa.

2.3) Numerical problem solving task:

S was given the inter-task rest interval. In the mean time, necessary arrangements for this task were made by the experimenter in the required manner. Then S was instructed as, “We are going to start the next experiment. It is an interesting task. We will engage you in a verbal numerical/mathematical problem solving task for some time. Subjects of your age find it quite interesting and challenging. Such tasks or items are embedded these days in various reasoning tests. You will be required to solve the mathematical/numerical problem in which three separate numbers of two digits will be given and you have to respond the fourth number or to question mark. Each problem will be exposed for a short time on the screen one at a time. You will not be allowed additional time. If you do not solve the problem within a précised time of 30 seconds the next problem will come automatically and you have to solve it in the fixed time. So be attentive and try to solve the problem as fast as you can. Think over each problem mentally and give response verbally aloud. In the same manner you have to solve till the last problem. You will not be provided any help of paper and pen. For each ‘right’ response you will be credited as ‘right’ and for each ‘wrong’ response you will be credited as ‘wrong’. Three similar problems will be provided for practice. If you face any difficulty/query during practice then you may ask immediately without any hesitation”. The S was asked, “Have you followed the procedure? If O.K., should I continue”? After taking his consent, actual procedure was started. Correct responses were recorded by making a check mark (✓) next to the item and incorrect responses were recorded by entering an ‘X’ next to the item. After first incorrect response, if S corrected it immediately, then his response was considered as ‘Right’. All slides were presented one by one through slide show. If S solved the problem under specified time (i.e. 30 seconds) or as early as he can, the next arrow (→) of the attached keyboard was pressed for the next problem to come. But if S found it difficult to solve a problem within the preset time, an additional time of 10
seconds (i.e. total time of 40 sec.) was allotted and even after the additional time, if S was not able to solve the problem, then we proceeded to the next problem. Time was noted by a stopwatch.

**Scoring:** This task required the Ss to understand the ongoing rule and changing rule with the help of examiners’ feedback. In other words, this task demands from S to understand the ongoing and changing conditions and to answer accordingly. Number of perseverative errors and number of 'blocks completed' were considered as the source of switch costs. Correct responses from trial 6 to 10 (in First block) and from 16 to 20 (in Second block) were considered as evidence of set formation (one for each and maximum two) and a crash in the same was considered as a failure in set maintenance. Perseverative errors were traced (in total numbers) from trial 11 to 14 when S made a response that would have been correct using the previous sorting criteria, but is now incorrect.

2.4) **Anagram solution task:**

During the inter-task interval, necessary arrangements for this task were made by the experimenter as required. Then S was instructed as, “We are going to start the next experiment. It is an interesting task. We will engage you in a verbal task of anagram solution for some time. Subjects of your age find it quite interesting and challenging. Such tasks or items are also embedded these days in various reasoning tests. You will be provided a letter string and your task is to uncover a meaningful word by rearranging all the letters of the same string. Each letter string will be exposed to you for a short time on the screen one at a time. You will not be given any additional time if you are unable to solve the problem in a time of 35 seconds, next problem of letter string will come automatically and you have to solve it in the pre-specified time. In this manner you have to solve till the last problem. Solve the problems as fast as you can. So be attentive. Think over each problem mentally and give response verbally aloud. You will not be given any help of paper and pen. For each ‘right’ response you will be credited as ‘right’ and for each ‘wrong’ response you will be marked as ‘wrong’. Three similar problems will be provided for practice. If you face any difficulty/query during practice, then you may ask immediately without any hesitation”. The S was asked, “Have you followed the procedure? If O.K., should I continue”? After taking his consent, the actual procedure was started. Correct responses were
recorded by making a check mark (✓) next to the item and incorrect responses were recorded by entering an ‘X’ next to the item. After the first incorrect response, if S corrected it immediately, then his response was considered as ‘Right’. All slides were presented one by one. If S solved the problem under pre-specified time (i.e. 35 seconds) or as early as he can, the next arrow (→) of the attached keyboard was pressed for the next problem to come. But if S found it difficult to solve a problem within a preset time, an additional time of 10 seconds (i.e. total time of 45 sec.) was allotted and even after the additional time, if S was not able to solve the problem, then we proceeded to next problem. Time was noted by a stopwatch.

**Scoring** - This task required the Ss to understand the ongoing and changing rule with the help of examiner’s feedback and switch to the new sorting (correct) rule. Number of perseverative errors and number of ‘set formation’ were considered as the source of switch costs. Correct responses from trial 11 to 15 (in First block) and from 26 to 30 (in Second block) were considered as evidence of set formation (one for each and maximum two) and a crash in the same was considered as a failure in set maintenance. Perseverative errors were recorded (in total numbers) from trial 16 to 20 when S made a response that would have been correct using the previous sorting criteria, but is now incorrect.

### 2.5) Critical Flicker Fusion Frequency- CFFF task

For the determination of ‘Critical Fusion Frequency (CFF)’, in the inter-task interval the apparatus was set in the ready condition - 100% intensity of light and keeping the flicker fusion frequency (FFF) knob at minimum position. Then S was instructed to, “view through the eyepiece hood and keep eyes as close to hood as possible. You will see that a flickering is going on in the light stimulus. You have to say ‘Yes’ when there will be fusion in the light stimulus i.e. no more flickering or a steady light source”. The FFF control knob was rotated in the clockwise direction, from a starting point of 15 Hz, uniformly and at slow speed, till the subject reports the fusion. The FFF (in Hz) was noted down from the LCD panel meter. Same procedure was repeated for five trials.

Similarly for the determination of ‘Critical Flicker Frequency’, the control knob was kept at maximum position. This time S was instructed as, “You will see a stationary light source. Say ‘Yes’ when flickering starts in the light stimulus”. The control knob was rotated in the anticlockwise direction, from starting point of 50 Hz, till the S reports a flicker effect of light
source. The critical flicker frequency (in Hz) was noted from the LCD panel meter. Similarly five trials were taken.

Before starting the actual procedure, one practical trial in each condition was given to make the S familiar with the system and was asked, “Have you followed the procedure? If O.K., should I continue”? Approximately the time elapses between 15 Hz to 50 Hz flesh level was 25 sec. As soon as S reported fusion or flicker, the frequency was recorded by the experimenter. The control knob was brought back to the original position and again the same was repeated. Same procedure was repeated for ten trials – five for fusion frequency and five for flicker frequency – and corresponding threshold frequencies were noted. The time interval between two observations was 30 sec. to allow the required setting for the next observation.

**Scoring** - Critical fusion frequencies (Hz) and critical flicker frequencies, for five trials each, were noted. Mean threshold frequencies (fusion & flicker) were calculated. Higher the frequency, the Nervous System (NS) is considered more labile, i.e. took less time in initiation and cessation of activity.

2.6) **Inspection test - Flexibility of Attention:**

S was given the inter-task rest interval. In the mean time necessary arrangements for this task were made by the experimenter in the required manner. Then S was instructed as, “We are going to start the next experiment. It is an interesting task. You will be shown some slides one by one for a brief period. On some slides you will see 6 circles of red color formed in two rows (3 each) with white background, while some are blank (no figure). On some of the slides, one of the six shapes/figures may of smaller dimension than the others. This smaller shape/figure will appear at any position i.e. its position will be changed at every occurrence. So, your task is to differentiate these shapes by size. When you detect a slide having one smaller circle, you have to verbalize ‘Yes’ and if you find that all circles are of same size then speak ‘No’.”

Before the actual starting of the experiment, 2-3 practice trials were given to make the S familiar with the task. The S was asked, “Have you followed the procedure? If O.K., should I continue”? After taking his consent, actual procedure was started. Then S was shown one slide at a time and his responses were recorded. In this way S was presented a series of successive signals (60 trials) containing critical signals and non-critical signals. Critical signals were considered those in which one of the six figures was of smaller dimension then the others, whereas in non-critical
signals, all six figures were of equal size. The critical signals were distributed at random in space and time; they made up 40 percent of the total stimuli. The duration of presentation of each stimulus was one second and inter-trial interval was 4 to 6 seconds. All slides were presented one by one on laptop.

**Scoring** – This task required sustained attention on the part of the subject as well as considerable flexibility in directing vision from one element to another on the test panel. S’s responses were scaled on the response sheet in the form of right (\(\checkmark\)) when critical signal was rightly detected – Hit, or when he said no when there was no signal – correct rejection and wrong (X) when critical signal was not perceived owing to a low degree of flexibility in attention – miss, and when he signaled ‘yes’ when there was no signal – false alarm. Right numbers of responses were counted as final score for each subject.

3. **Procedure for 3rd phase, i.e. Intervention**

After administering the tasks of 2nd phase individually to a large sample, Ss who exhibited a general tendency of difficulty in set switching or high switch costs on verbal and non-verbal tasks were selected and divided into two equal groups through random selection. Three tasks (concept formation test, numerical task and anagram task) were used to give explicit and implicit intervention. Though, the content of the tasks used for both groups was same yet they differ in the way of presentation as for explicit group-the problems were given with white background, whereas, for implicit-different background color were used at the change of the problem set. The procedure for each task administered here is given for both groups and the three tasks.

3A) 1st Group (Explicit Intervention)

3A.1) Concept Formation Test

Before the administration of computer-made test, 12 examples already present in the test were given to Ss. These examples made understandable what the S has to do. Ss were instructed as, “There are item-pairs containing 4, 9 and 16 letters and digits, which symbolize characteristics of objects and some, are common while others are not. You have to find out common characteristics (letters or digits whatever they are) and note them against the pair of item objects, under the heading of common characteristics, and write their names also against them, as you will see in the examples.” Examples were shown, and common characteristics and name were written thereon were point out. In the first six examples, common characteristics and name both
were there, while in rest of the examples, only names are given and S had to find out the common characteristics. Ss were told that all of these common characteristics (2, 3 and 4) will appear in different situation (4, 9 and 16 characteristics) in the test, which he had to abstract and name as they were the examples." Then the S was asked whether he had any difficulty or not. After his consent, he was told that he should be sure that he has abstracted all the common attributes and he has given them common name (as in examples).

All the 36 problems were presented one by one on laptop monitor. Time taken in the formation and attainment of a concept was recorded by a stopwatch. A maximum time of 60 sec. was given to S for every problem. If S was unable either to recollect the name or to abstract common characteristics up to 60 sec., he was allowed to see the pairs again and if necessary the examples. The time was noted from the exposure of the problem to its correct completion.

Scoring: Each correct completion of the problem was scored as one, and a half mark was awarded if the S reported correct common characteristics, but not the correct name. The total score was a sum of score thus obtained as per the test procedure although the scores of this phase were not used for further analysis, as the main objective of this phase was to intervene (rule based learning through practice) high switch cost Ss on other related task for examining the effectiveness of intervention at later stage.

3A.2) Numerical Problem solving task

After making necessary arrangements for this task, the S was instructed as, “We are going to start the next experiment. It is an interesting task. We will engage you in a numerical problem solving task for some time. You will be required to solve the mathematical/numerical problem in which separate numbers of two digits will be given and you have to respond the fourth number/question mark.” Apart from the basic instructions regarding the test, some verbal instructions were also given to Ss, “you have although done a similar task in the earlier phase of testing and have done well, however, with this task you will better learn to identify rules to solve the numeric series rather simply try for each item, separately”. After giving the instructions S was asked whether he has understood the instructions properly. He was also asked to clear the queries, if any. After getting his consent, actual procedure was started. Each problem was exposed for a short time on the screen one at a time. Same procedure was followed for the remaining Ss in this group.
Scoring of the responses was not required.

3A.3) Anagram solution task

Procedure: S was given the rest interval. In the mean time, necessary arrangements for this task were made as required. Then the S was instructed as, “you have although done a similar task in the earlier phase of testing and have done well, and however, with this task you will better learn to identify rules to solve the anagrams rather simply try for each item, separately.” After giving the instructions S was asked whether he has understood the instructions properly. He was also asked to clear the queries if any. After getting his consent, actual procedure was started. Each problem was exposed for a short time on the screen one at a time. Same procedure was followed for the remaining Ss in this group.

Recording and Scoring of the responses was not required.

3B) 2nd Group (Implicit Intervention)

All the three tasks of this group too followed the same procedure, except that the background color of the problems was changed after each block was completed in each of the task. The Ss were not told about this change and relevance of the cue explicitly. They were merely primed.

4.) Procedure for 3rd Phase 2nd stage, i.e. Post-intervention

With a rationale to examine the effectiveness of intervention strategies for those Ss of explicit and implicit intervention group having difficulty in set switching, post intervention phase, which involved retesting of Ss on the same tasks as of pre-intervention phase but with a change in rule, was carried out. The procedure followed for administering the tasks in each group was as follows.

4A.) 1st Group (Explicit)

4A.1) WCST:

Same procedure and instructions were employed to subjects as of 2nd phase (i.e. pre-intervention). Responses were recorded according to the new sorting criteria (i.e. N-F-C-N-F-C, Number-Form-Color-Number-Form-Color) and the scoring was also made according to the new criteria with reference to the original WCST scoring norms.

4A.2) Numerical task
The same procedure and instructions were followed as in 2nd phase. Responses were recorded according to the new sorting criteria and scoring was also made according to the new criteria with reference to earlier scoring of 2nd phase (pre intervention). The rule was to shift from subtraction to addition.

4A.3) Anagram task
The same procedure and instructions were followed as in 2nd phase, i.e. pre intervention phase. Responses were recorded according to the new sorting criteria and scoring was also made according to the new criteria with reference to earlier scoring of pre-intervention phase. The rule for anagram solution was 4-2-3-1 and 1-3-2-4 letter strings, respectively, for both blocks of problems.

4B) 2nd Group (Implicit)
4B.1) WCST
With a change/completion of a category, the colored sheet placed below the stimulus cards was also changed. Colored sheets were arranged and replaced in such a manner that testing procedure was not affected. This procedure was followed until the completion of all categories or the presentation of all response cards. In this stage, the order/sequence of sorting the response cards, procedure and scoring was same as that of 1st group of this stage. Red, green and dark yellow background colors were used in different blocks of problems.

4B.2) Numerical task, and
4B.3) Anagram task
With the same procedure as of 1st group (i.e. pre intervention), responses were recorded according to the new sorting criteria and scoring was made. The background colors of blocks of problems were changed for which subjects were primed during intervention.

In the end, a formal note of thanks was given to the subjects for cooperation in the experiments. Each subject was particularly requested not to reveal the context, procedure etc. of the tasks/experiments in their class.

The procedure described above for all the tasks/experiments was followed for each subject. The only difference was in 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 is as follows –

1. **Wisconsin Card Sorting Test** – scores representative of set switching phenomenon (see Appendix I)
   - Perseverative responses, perseverative and non-perseverative errors: Higher the scores and percentage of responses, higher the switch costs and vice-versa;
   - Failure to maintain set: Higher the score, lesser is set maintenance;
   - Number of categories completed: Higher the score, more is set switching and set maintenance and vice-versa;
   - Conceptual level response: Higher the score, higher is the insight into correct sorting principles.

2. **Stroop task** – Higher the scores on Color-Word task, lesser is cognitive interference and vice-versa (see Appendix II).

3. **Numerical task** -
   - Perseverative responses: More is the score, higher is the switch cost,
   - Number of categories completed: More is the score, higher is the set switching

4. **Anagram solution task** –
   - Perseverative responses: More is the score, higher is the switch cost,
   - Number of categories completed: More is the score, higher is the set switching
5. Critical Flicker Fusion Frequency (CFFF1) - CFF is higher in labile systems (an average flicker-fusion and fusion-flicker trials).

Critical Fusion Flicker Frequency (CFFF2) – CFF1 and CFF2 are positively related.

6. Flexibility of Attention scores (FA) – Higher scores on FA, higher is the mobility.

ANALYSIS

After scoring of responses and data entry, the data were subjected to statistical analysis. First of all the obtained scores were run for the testing of assumptions for multivariate analysis. It was found that the shape of the distribution was non-normal; therefore the monotonic transformation in terms of T-scaling was done. The adequacy and sphericity of measures was tested by Kaiser-Meyer – Olkin Measure of Sampling Adequacy and Bartlett Test of Sphericity, respectively. Certain statistics for description of data, e.g. Mean, S.D, Skewness, Kurtosis (Appendix III), were also done. In order to recognize various aspects/facets of set switching and generality of factors, Principal Component analysis was made through SPSS (version 18) package. Further analysis was done by rotating the data with Varimax rotation. For investigating the various facets of set switching, factor analysis was made on the tasks measuring set switching, i.e. WCST, anagram and numerical task’s scores. To investigate the generality of set switching process, all the variables of the study were accounted to factor analysis. Pearson’s correlation was accounted to identify the relation among WCST measures, cognitive interference mobility and lability processes. The t test was applied for examining the effectiveness of intervention strategies (pre intervention-post intervention) and also between explicit-implicit interventions. The description of results is presented in the next chapter.