SUMMARY

Many of our daily routine activities involve the execution and monitoring of habitual well-established routines, such as preparing meals and cleaning the bath, and these routines are considered to be established in memory that require little attention. Many other tasks, including problem-solving activities such as finding out why the remote of the television is working, involve a series of operations such as searching, matching, deciding, evaluating and transforming or performing. Another example of this is steeplechase race - an obstacle race which involves hurdles of different nature within a single race. In such situations, established cognitive skills may have to be reorganized to allow new or different patterns of behavior to be executed according to the changing situational demands. It is still controversial to decide exactly how such mental processes are controlled, but several theorists have hypothesized an 'executive mechanism', including Baddeley (1996) when proposing the central executive in his model of working memory. Norman & Shallice, (1986), have reported the importance of cognitive control processes, particularly in novel or difficult situations - situations that require a lot of planning, involvement in poorly learned responses, when mistakes/errors must be corrected with a fast pace, and when we have to think or act to conquer the leading (but not pertinent) tendencies.

It is a fundamental characteristic of human beings to behave according to changing environmental demands. This adaptability and flexibility in behavior are achieved with the help of cognitive processes. Due to this control and flexibility, we are capable of responding quickly and accurately in achieving our goals. For about two decades, researchers in the field of cognitive psychology have started to elucidate the phenomenon of mental set by experimental procedures. Such procedures include a set of rules that identify such conditions in which a task is performed; with a procedure becoming stronger the more practice. An important feature of executive control mechanisms is "the ability to quickly, flexibly, and efficiently switch mental sets between various kinds of information in a rapidly altering environment, commonly referred to as set-switching. In psychology, "set switching may be defined as a cognitive operation that entails an ability to switch response sets, whereby one must inhibit previously learned rules and apply new ones" (Barcelo & Knight, 2002). Such instances are more common and frequent in
educational contexts be it imparting instructions or evaluating through series of questions/problems.

Our present research was mainly emphasized on the cognitive control processes that are essential when automatic behaviour/processes are not enough to achieve targets. It is the most significant ability of human beings to adapt to novel situations and to shift from involuntary/automatically to voluntary/controlled behaviours in response to changing environmental demands/situations.

Detailed review literature shows that numerous studied on task switching following various paradigms have been conducted which emphasize mainly on the understanding of the specific cognitive processes, whereas, a little attention has been given towards the underlying general factors across different tasks and the relation between various set switching measures involving verbal and nonverbal tasks, interference or inhibition and temperamental measures of personality. Review of literature also depicts that a number of intervention or training programs/strategies have been developed or employed for reducing switch costs mainly using WCST criteria. Other situations have not been equally tried, e.g. verbal and numerical contexts.

So, present study was an attempt to focus on high switch cost individuals and to examine the effectiveness of some selected intervention strategies across different types of contexts. Main objectives of the present study were –

Objectives:

1. To study various facets of set-switching.
2. To identify the correlates (mobility, lability, cognitive interference, type of tasks-verbal and non-verbal problem solving) of set-switching.
3. To see the effectiveness of some selected moderating variables (explicit – implicit) as strategies among those having difficulty in set switching (high cost individuals) in relation to correlates.

Hypotheses:

1. The task demands will modulate set-switching during task performance.
2. People high on cognitive interference, low on mobility and lability will have greater difficulties in set-switching across tasks.
3 Explicit and implicit intervention will reduce difficulty in set switching.

4 Explicit and implicit intervention will have different effect.

The main study was divided in three main phases. A pilot study was conducted for task selection and task standardization before the final study. During the first phase of study, a large group of subjects was administered Jalota's group test of general mental ability. At the second stage, subjects within the average range of General Ability scores and who were available for all six tasks (N=296), were selected. Remaining subjects who didn't fall within the inclusion criteria (N = 110) and who were absent across testing sessions (N=22), were excluded. Thus, a total of 296 Ss were administered WCST, Color-Word Stroop task, Critical Flicker Fusion Frequency task, Flexibility of Attention task, Numerical and Anagram solution tasks, individually. 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 and were elected for third phase of study. A time gap of seven to eight days was maintained between 2nd and 3rd phase of study. 3rd phase of the study was divided into two sub-stages, i.e. Intervention (Stage I) and Post-intervention (stage II). Ss with high switch costs were further divided into two equal groups randomly. During the first stage, i.e. intervention, one group was provided explicit intervention (practice) on Concept formation task, numerical task and anagram task, while other group was administered same tasks but the way of presentation of each task was different i.e. all the tasks in explicit group were presented with a uniform white background color while tasks for implicit group (cue-priming) were presented with varied background color, e.g. red, green and dark yellow (background color changed with a change in category) individually. In addition to general instructions about the test, explicit group was also provided some more explicit instructions to emphasize rule learning, while implicit group was provided only the general instructions. Two tasks of this phase, i.e. numerical and anagram were also different from the first phase with a new rule of learning and with inclusion of new problems.

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. The same procedure was followed for all the Ss in both groups.

After the successful completion of 1st stage, i.e. intervention, post intervention (2nd) stage was on track. At this stage the effectiveness of the intervention strategies was analyzed in both groups.
on WCST, numerical task and anagram task. 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.

To fulfill the objectives of the study, appropriate statistical analysis were carried out. For achieving the first objective of the study data was analyzed through factor analysis was applied on tasks/variables measuring set switching. For investigating, the generality of factors, another factor analysis was employed on all measured involved in study. Second objective of the study was achieved by using correlation analysis between measures of WCST, cognitive interference and temperamental dimensions of personality. Third objective of the study was attained by comparing the mean differences of different variables were compared through paired sample t test and independent sample t test.

Major outcomes of the present study were as –

1. Factor analysis revealed three components. First component was a pure measure of set switching related to WCST. Second component was a measure of switch cost with a mix of variables from verbal (numerical and anagram) and nonverbal task (WCST). Third component was a measure of 'set failure' with other variables (correct responses and number of trials). The non-verbal, numerical and verbal problems revealed commonness in set formation, set maintenance and set switching.

2. Second factor analysis revealed four components with nearly identical representation of factors except one i.e. fourth component. This fourth component was a measure of temperamental dimensions of mobility and lability. Although, the phenomenon of set switching was observed through different measures across tasks, which revealed some unity among set switching measures. Cognitive interference and mobility as individualistic characteristics converged with cognitive set performance.

3. Tasks with more demands or with multifaceted nature were found to have high switch costs in comparison to tasks with low demands.
4. Correlation analysis showed that individuals with high interference, low mobility and low lability exhibited more difficulties in set switching through more perseverative errors and less numbers of categories completed.

5. Both explicit and implicit interventions were proved to be very effective in reducing switch costs. However, implicit intervention was found to be more effective.

Limitations

Study was limited in using only single standardized test measuring set switching, i.e. WCST, while the other two tasks, i.e. numerical and anagram, were not. Only the switch costs (and not mix costs) and near transfer was examined by the study. Though the findings revealed concurrent and construct validity of the new tasks.

Suggestions

More such standardized tasks measuring switch costs related to educational curriculum should be made. Mixing costs and far transfer of training intervention should be investigated.

Implications

Findings revealed patterns of assets and deficits that may be predictive of later generalized academic performance in various areas such as in arithmetic, grammatical and other performance task/activities by early neuropsychological assessment. Assessment of specific dynamic traits can help in placement and recruitment of right person in a specific profession for e.g. an acrobat must possess a mobile and strong nervous system. Findings may be also helpful in understanding various executive processes in a better manner and may lead to formulation of significant intervention planning for those who have same or similar difficulties and help us to deal effectively according to the changing demands or requirements of environment. There may be long term educative implications and even an enhancement in the feeling of self efficacy. Those who fail to maintain cognitive set also need to be focused as they shall be committing double edged errors in cognitive performances.