



## **FACTORS AFFECTING COGNITIVE FLEXIBILITY SKILLS AMONG B-SCHOOL STUDENTS**

### **Dr. B. Janakiraman**

Professor, Department of Management Studies Nitte Meenakshi Institute of Technology P.B.No:6429, Gollahalli, Govindapura Yelahanka, Bangalore-560 064



Dr. B .Janakiraman is currently working as a Professor in Nitte Meenakshi Institute of Technology, Bangalore. Before joining NMIT he was heading the Department of Management Studies at MSRIT for more than 15 years. He is a graduate in commerce from Madras University and Post Graduate in Management (AIMA) and masters in Business Administration (Finance). He obtained his doctorate from school of Management, Pondicherry University. He has also served Canara Bank for 23 years, SBI for a year and was a consultant for 6 years. He has completed the Lead Auditor Course of ISO 9001-2000. His other areas of interest include teaching HRM, Leadership and Quality. He has published several papers in reputed journals. He has authored a book Training and Development. He has also co-authored several other books on a variety of subjects like Entrepreneurship Development, International Financial Management, Management and Behavioural Processes, Change and Knowledge Management and Total Quality Management.

## ABSTRACT

*Cognitive flexibility is becoming increasingly relevant and critical for the placement of today's B-School students. Measuring the components of cognitive flexibility and finding out the factors responsible for development of the skill is the main objective of this paper. Measuring factors like cognitive switching, working memory, inhibition etc., may lead to bringing the right relevance and ability to adapt amongst B School students which can pave way for their right placement. Developing a questionnaire suitable to management students to measure this skill is a challenge and this study fulfils this challenge. This study found that factors like Working memory, Inhibition, Planning skills and Focused Attention have the strongest influence on Cognitive Flexibility.*

**Keywords:** Cognitive flexibility, Cognitive Switching, Working memory, Divided Attention, Inhibition, Planning skills, Focused Attention

### Research Article

#### 1. Introduction

**Cognitive flexibility** is defined as the brain's capability to changeover from thinking about one idea to another one. The faster one is able to switch or "shift" his/her thinking from one concept (e.g. size of an object) to another one (e.g. colour of an object), the greater is his /her level of cognitive flexibility. Cognitive flexibility can be explained as the ability to shift one's thinking (cognition) (or train of thought) as an adjustment to the requirements of stimuli. In neuroscience, the term cognitive flexibility is also otherwise called as "cognitive shifting," "mental flexibility" and "task switching." Some individuals would make a great effort to rapidly change between these two constructs due to their poor cognitive flexibility or "rigidity." Rigid thinkers are weak at adapting to the introduction of new stimuli and switching their thinking to adjust to various changes. It is considered as a critical executive function that paves way for adapting behaviors in response to environmental changes.

#### 2. Elements of Cognitive Flexibility:

Elements of cognitive flexibility are given below. Many authors refer to cognitive flexibility as one's capability to move between multiple thoughts. However some other authors think it covers views namely old beliefs updating, multi-faceted thinking, and/or finding out commonalities amongst totally unrelated concepts.

- **Cognitive Switching:** Cognitive flexibility most often refers to one's capability to swing between multiple concepts. While in conversation among friends, one is talking

about the rules of baseball all of a sudden the other friend starts talking about English literature the listener's capability to changeover between these two concepts would be considered flexibility of cognition.

In his book "The Personal MBA - Master the Art of Business Josh Kaufman (2012) asserts that cognitive switching attracts certain amount of penalty. Whenever, one shifts his/her focus from one subject to another; he/she incurs the *Cognitive Switching Penalty*. One's brain consumes time and energy thrashing, stacking and refilling contexts. Neurologically, cognitive switching is impossible. One is not really doing two things but switching his/her attention from one thing to the other. This penalty is a Friction cost: fewer times one switch, the lower will be the cost. Productive cognitive switching is a myth.

### **Working Memory**

Working Memory is the thinking skill that centers on memory-in-action. It is the ability to recollect and utilize pertinent information while in the midst of an activity. Working memory is sort of a workstation for you to hold designs in your mind's eye and play around them. The design of the memory can be actively manipulated. Working memory in short means idea manipulation. Through a string of trials, psychologists have learned that there exists this succinct type of memory in which memory designs are held. Working memory permits for active ideas and memory designs to be manipulated. Think about a car, whatever kind of car you want. Revolve it 360 degrees. Now make it red and white. This is effective mental manipulation, and it is happening in your working memory. Briefness is one of the most important parts of working memory. It is sometimes referred to as the visual sketchpad or an audio loop. The information remains as long as it does and then it goes away forever after a few seconds or if you get diverted. This is why people trying to remember mobile numbers have to continuously saying it; it is in their working memory. One bang, and the mobile number is gone forever.

### **Divided attention**

There are four types of attention namely- sustained, selective, alternating and divided. Divided attention is defined as "capability of one's brain to process two or more diverse stimuli at a time, and respond to the manifold demands of one's environment simultaneously". Divided attention is a kind of concurrent attention that permits us to deal with diverse information sources and accomplish multiple tasks at a time. As it permits us to

be more competent in our day-to-day lives, this skill is very important. This is otherwise known as multi-tasking. This skill has its limits. When the attention is divided, the efficiency of doing things decreases and will result in slightly lower than the superior performance. When a person has a hard time attending to two stimuli at a time, it is described by using a term called as interference. When one is eating and talking at the same time, or even when one is watching TV and talking on the phone, he /she is supposed to be using divided attention.

### **Inhibition**

Inhibition which is one of the components of cognitive flexibility is also included in the executive functions. Executive functions include initiative, inhibition, flexibility, planning, prevision, self-monitoring, verification and correction (Lezak 2004; Stuss 2011). These functions are incorporated in the frontal lobe as is confirmed by the observations that lesions in this brain area is the source for damaging of one or several of these elements (Luria 1986; Heilman and Valenstein 2003) Inhibition is the capability to hold back behavior directed to secondary or irrelevant goals (Nigg 2000), whereas flexibility refers to the capacity to alter the strategy according to the changing environments (Miller and Cohen 2001). Inhibition and Cognitive flexibility are significant for decision-making and problem-solving in managers.

### **Planning Skills:**

Managers must be capable of organizing staff and tasks into a schedule and monitor the progress. This schedule should outline the scope of work to be completed and a timetable for future action. It comprises of all actions that are to be resourced, scheduled and completed over a period of time to accomplish the outcomes. A manager should recognize and appreciate the general principles and processes of developing objectives, time schedules, methods and techniques. The B School students are expected to learn and master these skills.

### **Focused Attention:**

Focused attention is the capability of the brain to provide single minded concentration to a target stimulus for any period of time. Due to Focused attention it is possible to quickly identify the relevant stimuli. For attending to both the internal stimuli (feeling thirsty) and external stimuli (sounds) we use Focused Attention. It is an important skill for students in general and B School students in particular which allows them to efficiently and effectively carry out even their daily routine. Personal factors like motivation, energy level and emotions, Environmental factors like fewer distractions, and Stimulus factors like novelty,

duration, complexity and the number of stimuli at the same time etc., influences one's ability to keep focused attention on an activity.

### **3.Importance of cognitive Flexibility**

Cognitive flexibility is significant for switching attention and thoughts rapidly. Persons with low levels of cognitive flexibility are not capable of shifting from one conception to another, and often “stuck” in a one sequence of thought or aspect of concentration. If one is cognitively stuck then it is akin to watching just one TV channel or reading one book for the remainder of one's life, and they will have a difficult time adapting to changes and unusual stimuli.

What is helpful is to vary your viewpoint to accommodate new information. With cultural evolution overtaking the biological evolution continuously, cognitive flexibility facilitates you update your earlier belief system as an adjustment to new stimuli. In modern times if one does not know how to use computers or cell phones certainly he will be stuck and may not understand the perspectives of a newer generation.

Besides improving a person's talent to adapt when confronted with novel stimuli, cognitive flexibility is linked with improved brain functioning. It lets one's brain to function more efficiently, with different regions operating in unison. Persons with high levels of cognitive flexibility likely to have greater comprehension and fluency connected with reading, more fluid intelligence, and an increased sense of awareness.

Individuals with low levels of cognitive flexibility are usually “stuck in their ways” and hate novel stimuli. Such people have a difficult time in adapting to behavioral, psychological, environmental and technological changes. To maintain peak mental performance, people are suggested to engage in activities that increase cognitive flexibility which may provide significant benefits.

Cognitive flexibility explains one's capability to unfasten from one task and respond to another or manage multiple concepts simultaneously. Persons who are cognitively flexible will be able to become skilled quickly, have creative problem solving capacity, and adapt and tackle new situations more effectively. Hence it is significant in academic and workplace settings.

World Economic Forum Report 2016 examined the future of jobs in nine different verticals in 15 of the world's largest economies and opined that employers will soon be increasingly requiring cognitive abilities like creativity and adaptability. Hence building one's cognitive flexibility is very important for students and working professionals to develop and keep pace

with the ever changing future work environment. One of the best methods to become more cognitively flexible is to expose oneself to novel practices and new methods of doing things.

#### **4. Literature Review**

According to Chermahini & Hommel, (2012) cognitive flexibility leads to improved mood. They found that cognitive flexibility improved mood, whereas the convergent thinking which is opposite of cognitive flexibility decreased mood.

Dennis and Vander Wal (2010) defined cognitive flexibility is “the ability to switch cognitive sets to adapt to changing environmental stimuli [and] appears to be the core component for most operational definitions of cognitive flexibility” (p. 242).

Higher the cognitive flexibility, higher the level of coping with stress and trauma says Yehuda, Flory, Southwick, & Charney,(2006)

According to Beversdorf et al. (1999), Cognitive flexibility is *sine-qua-non* for problem solving. Alternatives generation and prioritizing are commonly needed for successful problem solving. This skill is much needed amongst managerial personnel. Planning skill and cognitive switching facilitates development of this skill.

Koesten, J., Schrodt, P., & Ford, D. J. (2009) found that cognitive flexibility was significantly responsible for young adult well-being outcomes like self-esteem, physical health status, and lesser mental health disorders

The organizations characterized by cognitive flexibility are more likely to respond well to the changing environment than those characterized by cognitive rigidity. Henderson and Clark (1990) as well as Gavetti (2005) suggested that organizations that are more cognitively flexible, defined as the ability of the managers to observe, process, and integrate latest information respond quickly and effectively to the changes in the environment. This study investigates the impact of various dimensions of cognitive flexibility on the students of management.

#### **5. Ways to develop cognitive flexibility**

The following practices may help students to develop cognitive flexibility:

1. Altering one’s daily routine.
2. Seeking out new experiences.

3. Practicing thinking out of the box creatively.
4. Not taking the easy way, but striving for deeper learning
5. Meeting new people.
6. Transferring what one has learnt in one context into a new context.

## **6. Objectives of the Study**

1. To determine the importance of Cognitive flexibility for the management students.
2. To identify the factors that influence the cognitive flexibility amongst students
3. To identify ways to improve cognitive flexibility amongst students that will facilitate their placements.

## **7. Research Methodology**

The success of any research depends on the systematic method of collecting the data and analyzing the same logically and sequentially. Use of both primary and secondary data was made in the present study. The present study has been mainly based on survey method. Primary data have been collected by issuing questionnaires directly to the respondents who are MBA students in an engineering college. Of the available students 100 students were chosen.

The data so collected has been analyzed using Factor Analysis with the help of statistical package for social sciences.

## **8. Limitations of the Study**

A limitation of this study lies in its small sample size. However there exists the potential for studying these skill sets for a wider student population.

## **9. Results and Discussion**

### **Factor Analysis**

Factor Analysis is a method used to convert a set of variables into a lesser number of linear composites, which have a highest correlation with original variables. Factor analysis is utilised to examine a complex product (or) services, in order to identify the key characteristics or factors considered important by the respondents. The intent of factor analysis is to determine whether the responses of several statements preferred by the respondents are significantly correlated. If the responses to the several statements are

significantly correlated, it is considered that the statement measures some factors common to all of them.

Continuous variables or interval scales variables is necessary to apply the factor analysis. Factor analysis is a kind of regression analysis. The factor analysis attempts to get the 'best fit' factor from the scattered data in such an approach that factors describe the variance related to responses to each statement. The researcher has conducted the factor analysis in the following stages in the present research.

1. Secondary Research
2. Questionnaire formulation
3. Data collection
4. Input feeding and processing
5. Output analysis
6. Identifying the factors
7. Conclusions

### **Factors Chosen for Analysis**

Cognitive flexibility in students was studied by selecting six parameters. Factor analysis and detailed analysis and discussions were done at various stages.

### **Statistics Associated with Factor Analysis**

**Bartlett's test of sphericity-** To test the null hypothesis that the variables chosen are not correlated with the sample universe Bartlett's test of sphericity can be used. Chi-square is the basis for this test. During the process of calculations transformations of determination of correlation matrix is considered.

**Kaiser-Mayer-Olkin measure of sampling** – The magnitude of partial correlation coefficient is compared by this index, with the magnitude of the observed correlation coefficient. Instant small values which specify the correlation between pairs of variables cannot be explained by other variables. With this indication, the factor analysis for evaluating a particular aspect will not be more appropriate.

**Eigen Values and communalities** – The sum of squared of its factor loading is indicated a factors Eigen value or latent route. The degree to which the given factor fixes the data gathered from the sample respondents is given by Eigen value. The sum of squares of a statement's factor loading describes the communalities of each factor contributions for the selected variables.

The factor matrix is constructed with the help of matrix loading and correlations between the variables and factors. A loading of greater than 0.5 will be for pure variables.

A questionnaire was prepared covering the identified factors of cognitive flexibility skills in students by Dr.B.Janakiraman, who plans individual profiling in future. All the 6 factors in the questionnaire of the present study were subjected for factor analysis by using Principle Component Analysis (PCA) with orthogonal rotation. There is no constraint on the number of factors. A factor loading cut off point of 0.50 was used for the sake of convergent validity.

TABLE NO.1.0 shows the reliability statistics and proves the data could support 78.1 percentage reliable to do this analysis. TABLE NO.1.1 indicates that the Kaiser-Meyer-Olkin (KMO) measures of sampling adequacy in the study are 91.2. This is good result, as it exceeds 0.5 Bartlett's Test of Sphericity which is 0.000, meaning that factors that form the variables are adequate.

**TABLE NO.1.0**

**Reliability Statistics**

The developed questionnaire has undergone Cronbach Alpha testing for testing its reliability and the value is given below:

**Reliability Statistics**

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.761	.781	60

**TABLE NO.1.1**

**KMO AND BARTLETT'S TEST**

<b>KMO and Bartlett's Test</b>		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.703
Bartlett's Test of Sphericity	Approx. Chi-Square df	93.926 15
	Sig.	.000

The following table shows the variables with the corresponding extraction communality factor value.

**TABLE NO.1.2**

**Variable with Extracted Communality:  
Factor Value – Significance of Cognitive Flexibility**

**Communalities**

	Initial	Extraction
Cognitive Switching	1.000	.525
Working Memory	1.000	.621
Divided Attention	1.000	.689
Inhibition	1.000	.407
Planning Skills	1.000	.590
Focused Attention	1.000	.651

Extraction Method: Principal Component Analysis.

Where,

- Factor 1 - Cognitive Switching
- Factor 2 - Working memory
- Factor 3 - Divided Attention
- Factor 4 - Inhibition
- Factor 5 - Planning skills
- Factor 6 - Focused Attention

**Total Variance Explained**

The following table No.1.3 reveals that the extraction has been undertaken by using principal-component method and the initial Eigen values are formulated from the communalities table and the same has been developed as extraction sums of squared loadings with percentage of variance and the relative cumulative percentage. From the initial Eigen

values and the extraction sums of squared loadings values, the rotation sums of squared loadings has been formulated and shown in the following table.

**Table No: 1.3 Total Variance – Cognitive Flexibility**

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
Cognitive Switching	2.339	38.989	38.989	2.339	38.989	38.989	2.017	33.616	33.616
Working Memory	1.142	19.037	58.026	1.142	19.037	58.026	1.465	24.410	58.026
Divided Attention	.815	13.586	71.612						
Inhibition	.686	11.429	83.041						
Planning Skills	.591	9.848	92.889						
Focused Attention	.427	7.111	100.000						

Extraction Method: Principal Component Analysis.

The extraction process has been carried out by using principal-component method, and it is found from the rotation sums of squared loadings and the total sum of 6 variables has been extracted and the same has been grouped into 2 components which have Eigen value of more than one. It ranges from component No. 1 to component No. 2 with the cumulative percentage from 38.99 percent to 58.02 percent. The percentage of variance ranges from 38.99% to 19.037%. For the second component of initial Eigen values, the total, percentage of variance and the cumulative percentage values are 1.142, 19.037 and 58.026 respectively. The extracted sum of squared loadings for the same is 1.455, 24.410% and 58.025 respectively.

From the analysis, it is inferred that the factor analysis has been supported up to 58.025% in this study. This is a good result and made the study reliable to the analysis.

The following Table No.1.4 has been formulated by using ‘principal-component method’ for extraction of variables into components and Varimax with Kaiser Normalization has been undergone by using ‘rotation method’. All the 6 variables have been considered and the analysis has been made to identify the influence of one variable over another.

### Rotated Component Matrix

The rotated component matrix is given in the following table. All the variables have significant factor loadings. The variables which have the maximum score of loadings are considered to be more important also has the greater influence on the factors selected.

**Table No: 1.4 Rotated Component Matrix<sup>a</sup>**

	Component	
	1	2
Cognitive Switching		.617
Working Memory		.569
Divided Attention		.798
Inhibition	.634	
Planning Skills	.697	
Focused Attention	.797	

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 3 iterations.

## 9. Findings

From the study the following findings were drawn:

1. It was found from the analysis among six factors Working memory (.0545), Inhibition(0.634) Planning skills (0.697) and Focused Attention (0.797) are highly correlated and also has the strongest influence on Cognitive Flexibility.(Table No.1.4)
2. It was found from the analysis the factors like Cognitive Switching(0.380), and Divided Attention (-0.228) has the least influence on Cognitive Flexibility.(Table No.1.4)
3. From the analysis, the students are not using their divided attention or multitasking to their full advantage. (Table No.1.5)

## 10. Suggestions

1. Working memory, Inhibition, Planning skills and Focused Attention contribute for developing Cognitive Flexibility to a greater extent amongst B School students. Initiatives like setting SMART goals, developing ability focus, removing inhibition and communicating accordingly, orienting them towards the constant pursuit and achievement of future goals, may go a long way in enhancing the Cognitive Flexibility. (Finding No.1)
2. B Schools should organize training programs for training students in developing Cognitive Flexibility.(Finding No.2)
3. Cognitive Flexibility will contribute in increased placement opportunities, increased adaptability and reduced resistance to change. This becomes *sine-qua-non* for effective career advancements. (Finding No.3)

## 11. Conclusion

The cognitive flexibility tenets are becoming increasingly relevant and critical for the success of today's students - especially in dynamic, tech-savvy industries. Effective use of working memory, multitasking etc may lead to bringing the right relevance and ability to adapt amongst B School students which can pave way for their success.

## References

1. Beversdorf, D. Q., Hughes, J. D., Steinberg, B. A., Lewis, L. D., & Heilman, K. M. (1999). Noradrenergic modulation of cognitive flexibility in problem solving. *Neuroreport*, 10(13), 2763–7.
2. Chermahini, S.A., & Hommel, B. (2012). Creative mood swings: Divergent and convergent thinking affect mood in opposite ways. *Psychological Research*, 76, 634-640.
3. Dennis, J. P., & Vander Wal, J. S. (2010). The cognitive flexibility inventory: Instrument development and estimates of reliability and validity. *Cognitive Therapy Research* 34, 241-253.
4. Gavetti, G. (2005). "Cognition and Hierarchy: Rethinking the Microfoundations of Capabilities Development." *Organization Science* 16(6): 599-617.
5. Josh Kaufman, *The Personal MBA: Master the Art of Business* Paperback – 28 Aug 2012 Portfolio; Reprint edition 2012
6. Heilman KM, Valenstein E. 2003. *Clinical neuropsychology*. New York: Oxford University Press.
7. Henderson, R. M. and K. B. Clark (1990). "Architectural Innovation: The

Reconfiguration of Existing Product Technologies and the Failure of Established Firms." *Administrative Science Quarterly* **35**: 9-30.

8. Koesten, J., Schrodt, P., & Ford, D. J. (2009). Cognitive flexibility as a mediator of family communication environments and young adults' well-being. *Health Communication*, *24*, 82-94
9. Lezak MD. 2004. Neuropsychological assessment. New York: Oxford University Press.
10. Luria, A. R. (1966). Higher cortical functions in man . New York: Basic Books.
11. Nigg JT. 2000. On inhibition/disinhibition in developmental psychopathology: views from cognitive and personality psychology and a working inhibition taxonomy. *Psychol Bull.* *126*(2):220–246.
12. Stuss, D. T., Alexander, M. P., Shallice, T., Picton, T. W., Binns, M. A., Macdonald, R., et al. (2011). Multiple frontal systems controlling response speed. *Neuropsychologia* *43*, 396–417
13. Yehuda, R., Flory, J. D., Southwick, S., & Charney, D. S. (2006). Developing an agenda for translational studies of resilience and vulnerability following trauma exposure. *Annals Of The New York Academy Of Sciences*, *1071*, 379-396