

## A Dynamic Executive Function Frame work for Linking Attention, Adjustment and Cognitive flexibility of School Children to Yoga: A Review

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### Abstract

In the age group of 5 to 13 years school going children there is always a fast growth of Executive Function (EF) parts of the brain. The EF growth gets shunted in the given school environment, where the growing genes of the children and their syllabus plays a major role. During this period, the children are loaded with heavy school curriculum and thus limiting the learning processes and creatively get lost in curriculum based growth. In this paper we propose to strengthen the EF functioning through a complimentary Yoga frame. This new frame gives us a protocol of yoga techniques to improve, the Attention, Adjustment and Cognitive flexibilities of the mind. Supplementation of yoga along with curriculum inculcates the habit of cognitive aspects of the brain which will make their carriers useful and betterment of the society. Yoga frame for children mediates the link between school curriculum and with EF resulting into better outputs underlying benefits of yoga.

**Keywords:** Yoga; Executive function; School children

### Introduction

The Executive Function is a positive behavior which helps in the dynamic developmental growth of the children in terms of attention, adjustment and cognitive flexibilities. In the presence of teacher and care taker, the dynamics of EF growth rate is faster than without the guides in the form of school faculty. The care taker plays an important role in taking care of the health status of the school children. The risk factors involved in the dynamic gets defined well as per primary health guidelines. Care managers along with doctor plays an important role in avoiding the risk factors involved on the positive impact in the self-management and attributed the outcomes to the strong “partnership” between the care manager and children in bringing the positive health [1]. This care taker management can promote better EF in each of the individual EF growth. The teacher and care takers act as guardians in partnering the children to come together and bring the team spirit and networking.

Research studies carried out by Kamkar et al. [2], shows that in a given dynamic environment of the school, the early childhood development of the children experiences gets stronger foundation, resulting into better skills development in the later part of the child's life - after 14 years adolescent age.

Yoga is defined as skill in action [3]. A CanDiD (Contextual and Dynamic individual Development) frame of reference suggested by Kamkar et al. [2] takes care of attention, adjustment and cognitive flexibilities of the children and links it to education in the form of EF of the child. This model not only takes care of the education but also the individual child's genetic behavior coupled with the school environment. The interface information and networks proposed an idea on social information and networks are discussed in great detail.

As per Melby-Levrag et al. [4] and Simons et al. [5] the training programs conducted on EF components are terribly mixed up and loosely used in the dynamics of growth of the children. Further they

elaborated that attention, adjustment are a set of skills and this experience provides technical inputs to the children and mental cognition filters or acts as a cognition filter that filters out unwanted distractions and examines the situation from various angles. The on-hand task switching [6] paradigms beget measurable changes.

These measurable changes are what we are interested in the child's EF growth. Cognitive and neurophysiologic changes measures higher order cognition. Skill up gradation tests are brought out [7] in the case of mental EF growth of the school going children.

These experiences are important for the children to grow nascent executive growth and drive functional and anatomical reorientation of associated neurological networks. Researcher discusses about overtime cognition and neurophysiologic mechanisms underlying in EF and familiarity of the situation grows along with age and becomes adolescent behaviour like situation of the child. Focused behaviour of working memory of the children are also disused and these results into a set of skills contributing to the development of EF faculties in the given school environment [7], also shows the same results of skilled growth of EF for the children.

There can be a gap in the CanDiD frame established by Kamkar et al. [8]. They discussed the dynamic frame without the Yoga frame. Specifically, understanding causes of yoga techniques related to Attention, Adjustment and Cognitive flexibilities development among the children remains to be a fundamental challenge. An attempt is made by researcher, but without CanDiD dynamic frame of reference. We mainly focused on this problem and proposed a CanDiD frame with yoga.

### Perspective

Our prospective is to review and make the school environment and individual genes plays an important role in Executive Function of the children along with yogic practices. The growth of the children in west is different from the Eastern schools. We bridged this gap by formulating an empirical relation comprising eastern yoga. We

formulated an empirical relation with a new frame which has a linear relation with age factor. This relation gives a protocol of yoga techniques to improve, the Attention, Adjustment and Cognitive flexibilities of the mind. Finally, through yoga, the children's EF is found to be better along with CanDiD frame of reference.

## Method

The methodology for CanDiD yoga dynamic frame of reference involves the following 3 assumptions:

a) Firstly, yoga is a dynamic and rhythmic breathing and physical exercise depends on surroundings ecology of the school.

b) Secondly, development is not a paradigm per say but it is a factor dependent on the surroundings for governing the EF practices.

c) Thirdly, each person is different from one another and it's a basic factor to be considered in yoga frame practices. This is an inherent assumption and fundamental requirement for better development of the EF.

Based on these assumptions, a review of the earlier studies carried out by one of the co-author.

In this paper, we use to test the Yoga CanDiD dynamic frame of reference with and without yoga (physical exercises). Ninety eight school children between the age group of 8 to 13 years were randomized as yoga and physical exercise groups (n=49 each; (Yoga: 15 girls, group mean age  $10.5 \pm 1.2$  years), (physical exercise: 23 girls, group mean age  $10.5 \pm 1.3$  years). Both groups were blind assessed after allocation, using:

- (1) The Euro fit physical fitness test battery,
- (2) Stroop color-word task for children,
- (3) Battle's self-esteem inventory and
- (4) The teacher's rating of the children's obedience, academic performance, attention, punctuality and behaviour with friends and teachers.

After assessments the yoga group practiced yoga (breathing techniques, posture, guided relaxation and chanting), 45 min each day, 5 days a week. During this time the physical exercise group had jogging-in-place, rapid repetitive movements and relay races or games. Both groups were assessed at the end of 3 months. Data were analysed with ANOVA and post-hoc tests were adjusted.

A second empirical test is also conducted in measuring the EF of the children through 3 independent parameters viz; attention, adjustment and cognitive flexibility. The dependent variable EF is assumed to be directly a function of 3 independent variables. The age is assumed to be in the range of chronological age and is linked to the EF through the constant 'a'. The linearity of the relation is governed by the constant, if  $k=1$ , it is linear, and if  $k \neq 1$ , it is nonlinear. Now the relation may be put in the empirical form given by:

$$EF = k \times a,$$

Where 'a' is assumed to be in the limits of 5 to 13 years, EF=Executive Function, k=constant and 'a' is the chronological age of the child. If  $k=1$ , it is yogic exercises and if not equal to 1, it is physical exercise which is nonlinear. We have made a clear distinction between yoga and physical exercises through the above empirical relation.

## Discussion

The two important findings of the study are:

A new CanDiD frame for Yoga

Empirical relation between Executive Function and EF in a dynamic CanDiD yoga frame with Chronological age of the children

The finding from the new frame for the school children is development of EF with and without yoga practices. Without yoga practice, it becomes nonlinear which is difficult to solve. A differential equation comes into effect and hence we dint go further in this regard. In the case of linearity the following Asanas and Pranayama techniques are suggested for the CanDid frame of reference.

a) Tada Asana (Mountain posture),

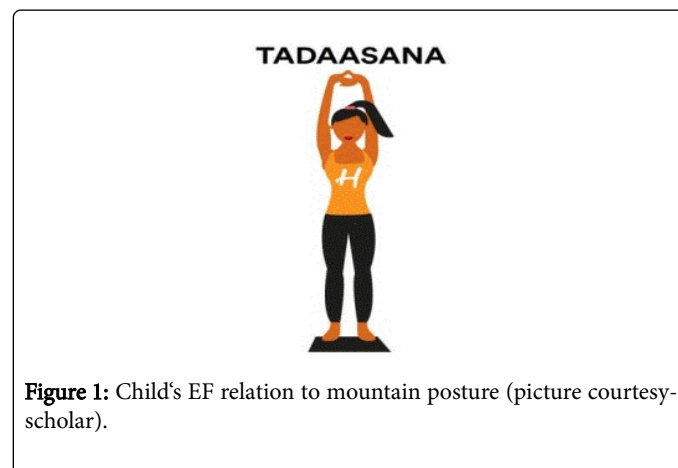
b) Sarvangasana (Both physical and breathing exercise which involves all parts of the child),

c) Vrikshasana (meaning linking the surroundings with Ecology),

The intervention and assessment of the above asanas.

### Tada asana

The nomenclature of the Sankrit word "Tada" indicates mountain and asana is posture. It is named as mountain posture because of its resemblance to the mountain. In the growing memory of the child, the attention gets diverted to the mountain which is a part of the Ecology. This gets forwarded to the adolescent age. The posture form is shown in the pictorial form (Figure 1).



### Sarvangasana

Repeat the asana 5 times in the early morning hours.

It energizes not only the body but also stimulates the EF of the child ever fresh throughout the day (Figure 2).

### Vrikshasana

The EF of the child gets stabilized without childishness through this posture. It may be repeated 5 times in the early morning hours. Apart from the EF, child can become a better sprinter because of strengthening in the ligaments and tendon from foot to buttocks (Figure 3).



**Figure 2:** Whole body bending coupled with breathing (picture courtesy scholar).



**Figure 3:** Tree asana (picture courtesy-scholar).

Despite the evidence demonstrating typical age-related individual changes in executive function, there are substantial inter-individual differences in EF of the children at all development stages. The proposed yoga model assumes inter-individual differences are a central characteristic of EF that are not reducible to variation between good and poor EF but it's diversity of strategies or approaches to organizing goal directed behaviour and cognition. As a cognitive trait, executive function varies from individual to individual as a consequence of both environmental and genetic factors.

Aspects of the early environment such as parental sensitivity [9,10] and exposure to adversity [2] impact EF factor. Heritage characteristics [11], Friedman et al. [12] plays an important role individual variation around the population mean can be largely accounted for by genetic influences suggests variation in executive function does not follow a continuum of good to poor, but a principal relationship between executive function and the nature of a child's early environments. One

example is gene environment correlation, where by individuals select environments that match their own genetic propensities [13]. This is best executive function related in age related increases in heritability estimates of executive function and related constructs like intelligence [14-16]. Another example is gene-environment interactions in which certain genetic variants bestow phenotypic stability while other bestows phenotypic plasticity. Gene environment interactions are evident in selected aspects of executive function such as self-regulation and decision making. Based on the above arguments on the genetic behavior of the child, it is evident that diversity is not only inherent but it is a starting point of development which is evident in developmental trajectories. Young children differ in the way they strategically organize their thoughts and action, and will consequently seek out environments that complement their yoga centered approach to self-regulation as they grow older.

In light of this important inter-individual variability, the yoga frame work emphasizes differences between children and others. There is need to recognize styles of learning that are deeply rooted in the nature of individual children. One implication of the study is to switch from passive mode of instruction to active mode of instruction which children are granted more active roles in selecting, modifying, and creating their own yoga experiences. On this view, an equal yoga system is not one in which all children are exposed to the same environment but one in which the children are given an equal opportunity and environment to learn [17]. Immense literature is available on yoga and its environment, rather than using computerized tasks that train a narrow range of cognitive processes, programs that allow for broad practice in EF promoting activities may be more successful.

Aerobic exercise, pretend play, yoga, and mindfulness meditation have all been implicated in improve EF [18]. A curriculum that targets broad activities and has shown promise in improving EF curriculum, which constitutes activities including pretend play, self-regulatory private speech, and dramatic arts. These activities are said to promote EF because they require inhibitory control. For example involving the attention and adjustment problems or acting in a drama on the stage, children must inhibit acting out of character. The experiments and tools [7], shows enough evidence that the development faculty in the growing children is rapid with the practice of mental and physical exercise tools.

### Limitations of the Study

1. Partial filling of West and East divide through CanDiD Yoga frame.
2. Empirical relation formulation requires further evidence.
3. It's only a qualitative review on child's EF with Yoga I study.
4. Out of many Yoga practices, we selected only 3 appropriate yogasan for the school children to improve the EF-Attention, Adjustment and Cognitive flexibility (AAC) techniques for the study.

### Conclusion

By linking CanDid frame with Yoga for school children is akin to linking the east and west cultures of developing the school children. The individual variation and their capacities depend on heritage and genetic factors of the child. A review of these studies are made and tried to connect them with yoga practices. The yoga practices will help the individual EF of the child to grow and step into adolescent age.

Apart from that Yoga can become a part of the school curriculum along with physical training practices.

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