Executive Functions: A General Overview for Parents and Teachers

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Executive Functions: A General Overview

The term Executive Functions refers to a diverse group of cognitive processes that act in a coordinated way to direct perception, emotion, thought and action. While the mainstream literature refers to executive functions as the "CEO" of the brain, studies of brain functioning suggest that executive functions are not a unitary trait, but a set of multiple cognitive capacities that act in a coordinated way. **A more apt analogy then would be that executive functions are the entire management structure of a multinational mind corporation.** Executive functions are responsible for a person's ability to engage in purposeful, organized, strategic, self-regulated, goal-directed behavior. As a collection of directive capacities, Executive Functions cue the use of other cognitive capacities including reasoning, language, visual and spatial, and memory capacities.

It is important to recognize that executive functions only give the commands to the rest of the brain; they do not carry out the commands. For example, executive functions are responsible for becoming aware of the need to use reasoning abilities to solve a problem and for delivering the commands to the other parts of the brain that are responsible for doing the reasoning. Because executive functions are distinct from other mental capacities, but interact with them in a way that results in efficient and effective performance and production, difficulties with executive functioning may explain why many bright children—with strong cognitive capacities—may fail to consistently demonstrate their knowledge or have difficulty following rules for behavior or regulating their emotions, even though they may be able to explain the rules or expectations for appropriate behaviors and emotional responses.

It is helpful to think of executive functions as a set of independent but coordinated mental capacities rather than a single trait. There is no guarantee that if one executive capacity is well-developed, all of them will be well-developed. Any person can have strengths and/or weaknesses in any one or more of the different executive functions at any given point in time. Assessment requires a multidimensional approach to identify the specific constellation of executive function strengths and weaknesses for any given child or adult.

A comprehensive model of executive functions involves multiple levels of executive cueing. At the lowest level, cues are provided for **Self-Activation** that involves giving the command to wake up and engage a state of consciousness. Once awake, a person's **Self-Regulation Executive Functions** can be involved in basic self-control of our perceptions, feelings, thoughts and actions throughout the day. While there is not yet consensus relative to the specific number of self-regulation executive functions, we propose 33 distinct self-regulation capacities that can be grouped into 7 clusters as follows:

Attention – Perceive, Focus, Sustain
Engagement – Energize, Initiate, Inhibit, Stop, Interrupt, Flexible, Shift
Optimization – Monitor, Modulate, Correct, Balance
Efficiency – Sense Time, Execute Routines, Sequence, Pace
Memory – Hold, Manipulate, Store, Retrieve
Inquiry – Gauge, Anticipate, Estimate Time, Analyze, Compare/Evaluate
Solution – Generate, Associate, Plan, Organize, Prioritize, Decide

Additional levels of executive control involve **Self-Realization** and **Self-Determination**. These executive functions direct a person's engagement with activities related to gaining an

understanding of personal strengths and weaknesses and how a person's behavior affects others, and developing a personal set of goals and long-term plans that motivate and drive behavior. Beyond these levels of self-control, an individual can engage in directive processes that attempt to engage the self in an active exploration of **Self-Generation** (asking oneself questions such as "Why do I do the things I do?" "What really motivates my choice of self-goals?" "What is the meaning or purpose of life?"), and possibly **Trans-Self Integration**, a transcending of the self to explore realms beyond self-generation through contemplation of the meaning of all existence or the ultimate source of consciousness.

Most clinical work in school settings with children focuses on dealing with Self Regulation aspects of executive control. As children enter adolescence, Self Regulation issues remain an important focus, but Self Determination and Self Realization issues begin to play a more prominent role in development. Self Generation and Trans-self Integration issues, if they emerge at all, tend to be addressed later in adulthood.

Domains of Functioning

It is important to realize that executive control can vary greatly depending on the domain of functioning that is being cued and directed by executive functions. A person can have strengths or weaknesses in regulation of any one or more of the four domains of ***perception, emotion, thought,*** or ***action***. For example, a person can have effective control of perceptions, emotions, and thoughts, but not be able to effectively use one of more executive functions in attempts to cue and direct actions. Another person might find it difficult to control emotions as well as actions but have little or no difficulty regulating perception and thoughts. The effectiveness of executive functions also can vary greatly within each of these four domains. For example, a person might have well-developed direction of gross motor capacities when playing sports but not fine motor capacities when holding a pencil and attempting to print letters and words. In the domain of thought, a person might be much better at cueing the use of reasoning with language than cueing the use of reasoning with nonverbal visual materials. In the domain of emotion, a person might have much greater control over the expression of joy or disgust than the expression of anger or sadness.

Arenas of Involvement for Executive Functions

In addition to the domains of functioning, executive function capacities can vary in effectiveness depending on the context in which they are being used. We call these varied contexts Arenas of Involvement and propose four distinct arenas within which the use of executive function capacities can vary greatly:

- ***Intrapersonal Arena*** – this is the arena where self-awareness and self-control directive processes are turned inward; these enable the ability to control one's own perceptions, emotions, thoughts and actions in relation to the self; i.e., self-discipline; they are involved in avoiding addictions and other self-destructive habits and behavior patterns, setting and maintaining personal goals and regulating purposeful behavior.
- ***Interpersonal Arena*** – this is the arena in which executive functions govern perception, emotion, cognition, and action in social interactions; where self-awareness and self-control directive processes are turned outward towards other human beings; they are involved in controlling one's actions in relation to others, in taking the perspective of others, in generating a theory of mind that enables a person to understand, infer, and predict the motivations, needs, and desires of others, and in weighing the benefits of cooperative behavior over self-serving behavior.
- ***Environment Arena*** – this is the arena in which executive functions direct and monitor

perception, emotion, thought, and actions in relation to both the naturally-occurring and the man-made physical world; these processes direct perception, emotion, cognition, and action in relation to the environment and engagement of the environment, including behavior toward other animals and living organisms and inanimate materials; interactions with machines and other man-made devices; this arena includes directing perceptions, emotions, thoughts and actions to avoid "accidents" by anticipating the impact and consequences of one's own actions towards, and in, the physical environment.

- ***Symbol System Arena*** – this is the arena in which executive functions direct and monitor interactions with/manipulations of human-made symbol systems (reading, writing, mathematics, computer use); directing perception, emotion, cognition and action involving culturally derived symbol systems; mediating learning and producing through interaction with information media such as words, numbers, figures, diagrams, schematics, programming codes and other "languages." Executive function direction in this arena can be highly specific as in other arenas. For example, it is possible to experience executive function difficulties with directing written expression but not with directing reading for comprehension.

Executive functions difficulties for a given person may be evident in any or all of the arenas. It is possible to have executive functions problems in only one of the arenas and be able to direct perception, cognition, emotion, and motor functions very effectively in the other arenas. More often, however, persons with executive function difficulties demonstrate problems in two or more of the arenas. Control of domains of function can vary within Arenas of Involvement; a person might have difficulties with specific executive functions in directing emotions in the intrapersonal arena (difficulties in directing how they feel about themselves), but not in the interpersonal arena (no difficulties in directing feelings about others).

Development of Executive Functions

Self-regulation executive functions are developing from the first years of life on throughout a person's entire lifetime. Large developmental shifts are noticeable, especially around adolescence. Because Executive Functions are developmental in nature, natural maturational delays and lags can be observed. Intra-individually, all executive functions do not develop evenly. For any given individual, one executive function can be more or less developed than any other executive function at any given point in time. Inter-individually, there is also great variation relative to chronological age. At the same age, different individuals will naturally vary considerably in their level of development of various executive functions. Cultural change points (e.g., educational transitions to Preschool, Kindergarten, 1st grade, junior high school, senior high school, college, graduate school, and workplace entry) can serve to highlight executive function developmental delays or significant deficiencies because, as the environment requires greater use execution functions, individuals may not have developed yet those requisite levels of executive functions control that are being demanded. Executive Function-based clinical syndromes, such as ADHD, demonstrate clear patterns of delayed developmental progression. Some researchers estimate developmental delays accompanying ADHD of about 30% associated with various Executive Functions such as the capacity to cue inhibition of impulsive reaction, modulating reactions, and focusing and sustaining attention.

Executive Functions and School

Although executive functions are used to guide cognitive functioning involved in new learning, many new learning situations are structured in ways that reduce the need for strong executive function involvement. In contrast to the learning situation, demonstrating what has

been learned usually requires significant involvement of executive functions to cue and direct production. Because executive control is heavily involved in demonstrating learning, executive functions difficulties usually manifest as "Producing Disabilities" much more so than "Learning Disabilities."

Internal Command versus External Demand

An important aspect of executive function engagement that is critical for understanding variations in everyday use of these capacities relates to the locus of intentionality for executive function involvement. The need for engagement of executive functions can stem from a person's own internal desires, drives, aspirations, plans, and proclivities, namely by *internal command*. On the other hand, if summoned by sources outside of the person, executive functions can be engaged through *external demand*. Executive functions use that arises from internal command utilizes specific neural networks routed through portions of the frontal lobes as well as other specific areas of the brain. These networks are distinct from, but not necessarily independent of, the neural networks of the frontal lobes and additional areas of the brain that must be activated when a person attempts to engage executive control in response to an external demand. Executive functions engagement by internal command is generally much easier to achieve because it flows naturally from the persons' own prevailing internal states. Engagement of executive functions in situations of external demand, however, requires much more mental effort and much greater capacity for self-control.

Many parents and teachers of children who demonstrate executive functions difficulties are often baffled by the seeming paradox of the child who functions so effectively when engrossed in activities of their own choosing, yet who seems woefully inept when requested to perform the simplest of household chores or classroom assignments. Parents and teachers who view these disparities often cannot help but think that the child's "sudden" incapacities are a matter of conscious choice – a convenient sham to avoid the hard work and effort that is being required of them. In actuality, most of these observed inadequacies are not a matter of conscious choice, but rather are the result of undeveloped, underutilized, or ineffectively engaged executive functions.

Executive Functions are not synonymous with traditional conceptions of intelligence

The extent to which executive functions can be considered as "synonymous" with intelligence depends on the definition of intelligence that is being offered. Extremely broad definitions of intelligence include executive functions along with just about everything else that constitutes efficient thought and action. Narrower definitions of intelligence often allude to the concept of executive functions, but subsume it under the heading of problem-solving. In fact, most of the research in cognitive psychology that deals with executive control processes refers to these mental functions under the heading of problem-solving and reasoning. Regardless of the definition of intelligence (with the exception of the concept of emotional intelligence), the role of executive functions in cueing and directing emotional processes is often overlooked.

Unlike theoretical definitions of intelligence, however, operational definitions of intelligence that are used to develop assessments of the psychological construct of intelligence usually do not include the use of executive functions as a distinct content domain and do not attempt to assess the role of executive functions per se as a part of test performance even though executive functions are often involved in many ways in the performance of the tasks that are used to assess intelligence. The manner in which most tests are constructed (explicit directions, teaching items, examiner cueing of attention and performance), however, usually reduces the impact of the examinee's executive functions on performance of tasks thought to assess intelligence. Even with the reduction in executive functions demands in many tests, intelligence

test scores sometimes do not accurately reflect a child's capacity for the use of executive functions. As a result, the following observations typically hold true:

- Correlations between most of the "purest" executive functions measures and measures of general intelligence tend to be very low (.20's, and .30's; i.e., a 4% to 9% overlap between measures of intelligence and measures of executive functions). This is especially true when a concerted effort has been made to minimize the overlap between the two types of measures.
- In cognitive neuropsychological parlance, executive functions can display a "double dissociation" from the specific cognitive abilities that are typically assessed on intelligence tests, such as reasoning with verbal information or reasoning with nonverbal visual material. This means that it is possible to identify individuals who are strong in executive functions, but weak in reasoning in a particular area, and vice versa (some individuals have relatively weak reasoning capacity but have strong executive functions related to cueing and directing the little reasoning capacity that is available, while other individuals have relatively strong reasoning capacity but relatively weak executive functions related to cueing and directing that reasoning capacity).
- The distinction between executive functions that direct mental processes and the mental processes such as reasoning, visual perception and discrimination, language, memory, attention, and motor acts that are being directed by executive functions, is critical for a clear understanding of the broader picture of a child's cognitive strengths and weaknesses. An understanding of the directive nature of executive functions can add considerable explanatory power to the clinical picture of a child with learning and/or "performing" difficulties who appears to have a number of cognitive strengths but is unable to use them effectively to produce the desired academic outcomes.

The relationship of reasoning and executive functions is an area of great debate. Some researchers espouse the idea that reasoning is an executive function. Others view executive functions as separate from reasoning. We hold the latter belief, primarily based on empirical evidence of performance on measures that primarily assess reasoning abilities and measures that primarily assess executive function control of reasoning abilities. Many individuals can effectively perform specific reasoning tasks that do not require a great deal of executive function control to complete, but are unable to complete simple reasoning tasks that do require a great deal of executive function control to complete.

Executive Functions and Language Processing

A related topic of much debate is the role of language in executive functions and other mental capacities such as working memory. Some researchers, philosophers, and clinicians believe that language plays a central role in all aspects of the development and use of executive functions and working memory, implying or specifically stating that executive functions and working memory processes are not even possible without the generation and manipulation of internal language (self-talk). Others argue that language is not central to all aspects of executive functions or working memory and that only certain aspects of higher levels of consciousness are likely to be constrained by language.

Readers should keep in mind, however, that the argument against the idea that language is central to the development and use of executive function and working memory processes is not a denial of the role that language can play in the control of self-regulation processes. Many clinical approaches have demonstrated how effective "self-talk" and language-driven executive function control can be in modifying executive function cueing and directing of perceptions, emotions, thoughts and actions. Ross Greene's work with explosive children effectively uses

language to help the child develop a vocabulary for self-expression and problem-solving. A therapeutic format with self-talk playing a central role has been used by Jeffrey Schwartz to effectively treat obsessive-compulsive disorder. Reuven Feuerstein's mediated learning approach keys off of verbal descriptions of control processes and how to think about thinking. The Tools of the Mind early childhood curriculum teaches children how to use language to increase self-regulation. The field of cognitive behavior therapy is one of the most effective evidence-based therapies; it teaches individuals to use self-talk to increase their capacity for self-regulation. Language therefore is an effective cognitive tool that can be co-opted to improve the use of deficient or delayed executive functions. Indeed, it would seem that language is the most effective tool we have for re-programming our own brains and minds. The fact that language can be used in this way, however, does not mean that language is the basis for all effective executive functions use or that executive functions use at any of the levels cannot be carried out successfully without the use of language. It is important to recognize that language is a relatively slow mental capacity. Many situations that we encounter in daily life unfold so quickly that we do not have time to "talk to ourselves" in order to self-regulate effectively. In these situations, executive functions are able to by-pass language and provide the needed commands to other parts of the brain so that we can perceive, feel, think and act effectively.

Executive Functions and Diagnostic Categories

While it would seem practical to have a specific diagnostic category with a name such as Executive Dysfunction or the like, the diagnostic puzzle related to executive functions cannot be put together quite that simply. In terms of existing clinical diagnostic categories, the connection between AD/HD and executive function difficulties is probably the most obvious. The *Diagnostic and Statistical Manual for Mental Disorders, Fourth Edition, Text Revision* (DSM-IV-TR; American Psychiatric Association, 2000) definition of AD/HD includes reference to difficulties with both inhibition, modulation, and attention. Although individuals accurately diagnosed with AD/HD demonstrate difficulties with inhibiting and modulating perceptions, emotions, thoughts and/or actions as well as focusing and sustaining attention, many of these individuals also demonstrate other self-regulation executive functions difficulties.

The obvious connection between AD/HD and executive functions difficulties has led some professionals to think of all individuals with executive functions difficulties as having AD/HD. This is clearly not the case. Rather, the ADHD diagnosis encompasses a core set of self-regulation difficulties common to all individuals accurately diagnosed with AD/HD (the self-regulation executive functions of inhibit, modulate, focus, and sustain) along with additional executive functions difficulties that vary greatly from person to person. This is one of the reasons why professional consensus on all aspects of AD/HD has been, and remains, difficult to achieve. There are many individuals, however, who do not have problems with cueing inhibition or modulation or with focusing and sustaining attention, but who have many difficulties with the use of other executive functions, and therefore do not meet the diagnostic criteria for AD/HD.

Terms such as *executive dysfunction* and *dysexecutive syndrome* are sometimes used to refer to individuals with executive functions difficulties, though these terms currently do not relate to any specific diagnostic schema that is widely agreed upon. For example, there is no DSM-IV-TR diagnostic category of Executive Dysfunction or Dysexecutive Function Syndrome, and at this point in time (2010) such a diagnostic category has not been listed as being considered for inclusion in the next edition of the DSM.

Although there could be some merit in the development of a separate diagnostic category or educational classification for executive functions difficulties, the greatest challenge to such an approach is the fact that the diagnostic criteria of most clinical conditions encompass difficulties with the use of one or more executive functions. In many ways, the DSM-IV-TR can

be thought of as a *behavioral user's guide to all the things that can go wrong with the frontal lobes*. It is our opinion that simply including a new diagnostic category for executive functions difficulties in future revisions of the DSM will not sufficiently address the central role that executive functions difficulties play in most of the existing DSM diagnostic categories. The new edition of the DSM, therefore, would have greater clinical utility if it were to incorporate a new axis that could be used to identify specific executive functions difficulties experienced by an individual along with the various clinical diagnoses that might be assigned. Following this line of reasoning, the pervasiveness of executive functions difficulties of one type or another associated with most of the mental disorders experienced by children and adults makes clear the need to carefully assess the nature of the executive functions difficulties of these children and adults so that appropriate interventions can be identified and implemented (In DSM parlance, a new Axis would be required to identify the level and degree of executive functions difficulties being experienced by the person in order to formulate an appropriate course of intervention).

Assessment of Executive Functions

Although assessment of executive functions is not yet a standard part of all psychoeducational assessments, a number of instruments have been developed over the last decade to assess the executive functions of children. We observed that almost all of these measures are standardized, norm-referenced individually-administered tests that share a common set of limiting characteristics: 1) they utilize only a formal direct approach to data collection from a single source – the child; 2) they focus assessment on executive functions direction of information processing capacities only within the domains of perception, cognition, and action; and 3) they focus only on directing the use of information processing capacities in relation to functioning in the symbol system arena.

To correct for this narrow focus, the recommended approach to the assessment of executive functions is a multidimensional, multimethod one involving both formal and informal techniques applied both directly with the child and indirectly with parents, teachers and others who know the child well. These techniques included, but are not limited to:

Direct Observation
- Standardized, individually-administered norm-referenced tests
- Qualitative process-oriented observation of cognitive processes during task performance.

Behavior Ratings
- Parent and Teacher Ratings of Child
- Adolescent and Adult Self-Rating Scales

Behavior Observations
Clinical Interviews
Anecdotal Records
Case History

Issues related to intervention

The ultimate goal of any intervention designed to address executive functions difficulties should be to increase the child's capacity for internally directed self-regulation.

Key Concepts for Guiding Efforts to Help a Child Improve Executive Functions

1. *Executive difficulties are associated with sub-optimal brain function*. While it might appear to be the case that the child is consciously choosing how to perceive, feel, think and act when a lack of production is observed, proper conceptualization of executive difficulties

requires an acknowledgement that the observed problems most likely are the result of less than optimal nonconscious brain function rather than consciously choosing to act in a contrary manner. Parents, teachers and others involved with a child with executive difficulties must be careful not to attribute the particular production deficits they observe to character flaws or consciously chosen states of mind, such as laziness, lack of motivation, apathy, irresponsibility, or stubbornness. It also must be understood that immediately changing that current state of brain function most likely is not within the nonconsciously or consciously-controlled skill set of the child.

2. *Brain function can be altered through intervention*. While it is certainly true that, in cases of more severe brain damage, neural networks have been altered or damaged to the point where little change in the current level of executive function capacity is likely, these cases are much more the exception than the rule. In the absence of clear evidence that the child was born with severe brain damage or has suffered a severe traumatic brain injury, it is best to assume that a child possesses the neural capacity to alter their current state of brain function. The important assumption here is that internal change that would enable the child to demonstrate the desired self-regulation capacities is possible. This optimistic stance enables the clinician to develop an intervention plan with the goal of positive change rather than the goal of simply managing a sub-optimal state of functioning. A lack of progress over time toward positive goals, however, may necessitate the inclusion of behavior management strategies to deal with a child's current lack of executive control.

3. *Interventions can activate the use of intact brain function*. If the observed executive difficulties are the result of disuse of intact neural capacities, then an intervention plan focused on positive behavior change goals will focus on teaching the child how to activate the existing executive skills neural networks through practice to achieve positive behavioral goals. In this situation, the amount and rate of progress toward positive behavior goals will be constrained only by other contextual factors such as the level of functioning of other cognitive capacities (e.g., the child's capacity to benefit from language-based learning).

4. *Maturational delays in the development of executive capacities will slow the rate of progress during intervention efforts*. When the child is experiencing delays in the development of one or more executive capacities, progress toward positive goals is likely to be slower and less consistent than might be expected even when other contextual factors are not creating any conditions that might constrain progress. In some cases the presence of developmental delays can be established at the outset. In other cases, if intervention attempts progress over time with less than the desired results, even after modifications in the strategies used to obtain results, the presence of developmental delays is the most likely source of the lack of progress. The presence of developmental delays however, does not indicate that the child will never further develop these executive capacities; it will just take them longer to develop these capacities. Appreciating the nature of developmental delays enables all involved in intervention efforts to maintain hope for future results and offers the encouragement needed to maintain patience with the slow rate of progress that might be occurring. Although as time progresses, the lack of progress might suggest to some that the child is not capable of developing the executive capacities they lack, in the absence of clear physical evidence of severe neural dysfunction, the best course of action is to maintain a positive outlook and continue to assist the child in their efforts to improve these executive capacities.

5. *Most executive difficulties reflect an inability to respond effectively to external demands for the use of executive capacities.* One of the most difficult paradoxes to reconcile in the minds of the parents and teachers of a child experiencing executive functions difficulties is why the child seems so capable of using executive skills when engaged with activities that they enjoy, and yet seems so inept at engaging these same executive skills when requested to do so for

tasks the child finds uninteresting or difficult. It would seem that the ineptness is a matter of choice and reflects an apathetic or oppositional stance by the child. In actuality, the paradox reflects the difference between executive capacity engagement by internal command and engagement by external demand. Under conditions of internal demand, when the child is motivated to perform a task, the synchronization of reward centers of the brain and executive capacities happens non-consciously and enables a natural flow of perceptions, feelings, thoughts and actions consistent with the desired outcomes. Conversely, under conditions of external demand, when the child is being commanded by others to perform a task, the child must first disengage from the natural internal connection between reward centers and executive capacities, flexibly consider the external request being made, determine what it will take in the way of perception, feeling, thought and action to comply with the request, engage the needed executive capacities to cue and direct the perceptions, feelings, thoughts and actions needed to fulfill the request, monitor the adequacy of performance, and correct any errors that might be made. Moving from the natural state of responding to internal command to the unnatural state of responding to external demand is a skill that eludes many children who experience difficulties with the use of executive functions. For these children, their difficulties with responding on external command are as mystifying to the child as they are to the parents and teachers who impose the demands. Because the child does not understand what is happening with their brain and cannot explain to themselves or others, typical reactions to external demands can range from simply ignoring the request to explosive episodes of frustration and anger during which many things may be said that do not really accurately reflect what is happening with the child.

6. *Executive difficulties are reflected in producing difficulties much more than learning difficulties.* Understanding how executive functions are involved in learning and in demonstrating what has been learned is critical to planning and implementing appropriate interventions. Self regulation executive function capacities play a critical role in the learning process as they are used to effectively coordinate the interplay of various cognitive capacities. Children who exhibit executive function difficulties require much more input from other sources to assist them in the learning process. When good classroom instruction practices are used, students with executive function difficulties are able to make more efficient use of other adequately developed cognitive capacities.

It is critical to note however, that addressing executive function difficulties during instruction does not guarantee that adequate production will be obtained from those with executive function difficulties when new learning is assessed. When executive capacity difficulties are exhibited, inefficiencies in the learning process are manifested in inadequate forms of production (for example, inadequate responses to questions during instruction, failed tests, poorly completed or undone assignments and projects). If the individual learner has not been taught how to overcome their executive capacity difficulties, these difficulties are likely to impact efforts at demonstrating what is learned even though learning did take place. Because learning is judged, not on the process of learning, but rather on the product of that learning, students who demonstrate executive function difficulties can easily be mislabeled as having a learning disability when in fact, they have what is more appropriately termed a *producing disability*.

In other words, producing disabilities (or in their milder form, producing difficulties) are not the same thing as learning disabilities (or in their milder form learning difficulties). This distinction is critical to understanding the nature of the problem and how to address it. Learning disabilities involve the disruption of basic processes such that initial perceptions are not adequately prepared for mental representation When learning disabilities are exhibited, a person is much less capable of learning new skills and building skill-based lexicons. Although

demonstration of what has been learned will be poor for these individuals, the source of their poor production is the learning disability not a producing disability.

The situation is different however for the child who does not have a learning disability but who does have executive function difficulties. In the absence of a learning disability, the person will be able to learn effectively as long as the executive function difficulties are being addressed effectively during instruction and/or during periods of study. When assessment of what has been learned involves a degree of self regulation beyond the person's existing capacities and no support is offered during the assessment, the person is at risk of not being able to demonstrate what they have learned (i.e., a producing disability).

Students whose executive function development is lagging in one or more areas often have difficulty consistently producing at levels that effectively demonstrate what they have learned, especially during the initial period of a transition to the next level of schooling. Such "surprise" nose dives in academic production often occur during three specific education level transitions: form elementary to middle or junior high school; from middle or junior high school to senior high school; and from high school to a post-secondary setting such as a college or a technical school. There are many possible reasons for the sudden appearance of executive function difficulties during educational transitions. Abrupt shifts in teaching style; an increase in the number of teachers and teaching styles; increased complexity of learning and production demands and increased expectations for self-direction of learning and producing all can have a negative impact on students who do not possess the executive function capacities needed to handle the changed conditions.

Along with the six basic principles above, several other issues must be considered and addressed when helping a child improve executive functions:

1. *Balancing the teaching of internal control with requirements for external control*. Although the goal of any intervention should be to increase the child's capacity for internally directed self-regulation, many interventions are likely to involve one or more external control strategies in the initial stages to begin the process of modifying the impact of executive difficulties. Effective interventions, therefore, often will involve finding the proper balance between teaching the child strategies and techniques that will affect internal change for improving self-regulation, while simultaneously supplying the requisite external controls that might be needed to support the child and manage behavior as long as severe self-regulation difficulties are being manifested. As a child learns to increase the use of existing executive capacities, or experiences developmental shifts which increase the engagement of executive capacities, the external controls can be lessened gradually with the goal of eventually being eliminated altogether. Careful monitoring of progress during the intervention period is required to enable the clinician and the child's parents to make the necessary decisions about the timing and extent of alterations made to external control contingencies.
2. *The executive function environment in which interventions will be implemented.* The effectiveness of any intervention attempt will depend greatly on the executive capacities of those most closely associated with the child – family, friends, teachers, administrators, etc. A caring environment populated with individuals who exhibit at least average levels of executive development and use can help the child in many ways. Such individuals are more likely to model effective use of executive capacities and help with the implementation of a consistent intervention plan and are more likely to be counted on to react appropriately to the executive miscues of the child.
3. *The use of rewards and punishment during intervention*. The effectiveness of the use of rewards and punishments in interventions depends on the nature of the executive difficulties. If

the child's difficulties are related only to disuse due to a lack of awareness of the need to engage executive functions or a lack of desire to do so, rewards and punishments may provide the impetus needed to change externally demanded conditions into internally commanded conditions thereby increasing the likelihood of effective use of the needed executive functions. In the case of a child with more severe executive skills and/or executive functions deficits or maturational delays however, the difficulties they experience with external demand conditions cannot be overcome simply with a shift to an internally commanded context. As a result, rewards will never be obtained and/or punishment will always be delivered, likely resulting in anger, frustration and withdrawal or refusal. The lack of production evidenced in these cases typically is not the result of a lack of motivation to engage but rather a lack of capacity for doing so. A lack of effectiveness of a behavior management plan that emphasizes reward or punishment signals the need to incorporate a teaching component as part of the intervention in order to build the capacity to respond effectively. Even when rewards and punishment produce the desired results, it should be realized that programs that rely strictly on rewards and punishment to produce the desired results are only external forms of control. They do not teach a child to become consciously aware of, reflect on, and internalize the regulation of behavior; they simply reward the presence of the behavior and/or punish its absence.

4. *Maturation of frontal lobe neural circuits.* Given that executive capacities follow a developmental progression dependent on the maturation of the neural circuitry of the frontal lobes, perhaps the most powerful intervention tool is time itself. Over time, most children and adolescents gradually improve their capacities for self-activation, self-regulation, self-realization, and self-determination. Problems arise when cultural expectations impose arbitrary timelines on brain function development. For children faced with overly aggressive expectations for brain maturation, a little time may be all that is needed to achieve the desired levels of executive capacity. For others with more substantial developmental delays, the ultimate solution to the executive difficulties may simply be more time to allow for greater development. One of the goals of working with a child experiencing executive difficulties should be to help family members develop a perspective that engenders hope for the future. Discussing the developmental nature of most executive difficulties offers the clinician an opportunity to help the family reframe the issues in a more positive way and maintain hope for future improvement. While maturation is likely the single most significant factor in determining the ultimate resolution of executive difficulties, this does not mean that clinicians and family members should adopt a wait and see approach to dealing with current problems. Energy and effort should be put into developing and implementing interventions in the present that attempt to produce positive behavior changes in current areas of difficulty. Appreciating the likelihood of a slow trajectory of neural development for the child, however, provides the impetus for professionals and parents to persist with intervention efforts, remain patient, and maintain hope for improved functioning in the future despite less than optimal results in the present.

A set of general intervention strategies that have been most effective in producing positive behavior change and academic production and improving the use of self-regulation capacities is presented in Rapid Reference 11.9. This list was developed from a broad-based review of the intervention literature (McCloskey, Perkins, & VanDivner, 2009). The strategies discussed in this section are organized into four general categories:

1) Orienting strategies – these strategies are designed to increase the child's awareness of executive capacities and awareness of the executive difficulties that the child may be experiencing, and to set goals for behavior change through increased use of executive capacities;

2) External Control strategies – these strategies are designed to manage executive difficulties; they involve things that others will do to have an immediate impact on the child's perceptions, feelings, thoughts and actions to ameliorate problems;

3) Bridging strategies – these strategies are used to teach executive skills, to help the child engage existing executive skills that are not being used, to help the child practice underutilized executive skills, to increase the child's awareness of when to engage one or more executive functions, or to increase awareness of how to engage one or more executive functions to respond effectively under conditions of external demand; and

4) Internal control strategies – these strategies are used help the child improve the capacity for internal self-regulation of executive capacities without input from others.

All of the strategies described here, with the exception of pharmacology, are applicable to efforts to improve the use of the full spectrum of executive capacities used to direct perceptions, feelings, thoughts, and actions within the intrapersonal, interpersonal, environment, and symbol system arenas of involvement and in multiple settings within each arena (e.g., home, school, community). When tailoring an intervention for a specific child or a group of children, the orienting strategies listed should always be used. Beyond the orienting strategies, interventions will need to be tailored to fit the specifics of the case. External, Bridging and Internal strategies represent a layered continuum of intervention options.

The number and type of strategies employed will depend on the specific executive strengths of the child and the severity of the executive difficulties that are being exhibited. The more severe the executive difficulties the more likely it will be that multiple strategies will need to be used from the External Control category, and the more likely that these strategies will need to be employed for prolonged periods of time. Over time, the External Control strategies would gradually be supplemented with Bridging strategies. As Bridging strategies increase in effectiveness, External Control strategies are faded out. Ideally, over time Internal Control strategies would be introduced to supplement the Bridging strategies, eventually allowing for the fading out of the Bridging strategies and exclusive reliance on self-regulated Internal Control strategies. Children with milder executive difficulties and multiple executive strengths may move directly from Orienting strategies to Bridging strategies and make rapid progress toward the introduction of Internal Control strategies. A child (usually self-referred and older) presenting with only minor executive difficulties and many executive strengths may move directly from Orienting strategies to Internal Control strategies.

General Strategies for Improving Executive Functions

Orienting Strategies

Establishing Intervention Goals – At the outset of the intervention, specific goals should be established collaboratively with the child. Each goal should represent specific actions, thought patterns, emotional states, or modes of perception. Each goal should be demonstrated or modeled in a concrete way so that the child has an experiential template that can be used to visualize and guide growth toward the goal. During interventions, goals should be revisited an demonstrated again to keep them fresh in the child's mind. Progress toward the goals should be documented so the child can see the growth over time.

Increasing Awareness of Executive Capacities – In tandem with the setting of goals for intervention efforts, the clinician will want to discuss the nature of the executive capacities that are required to achieve the intervention goals. Explain in basic terms what executive skills do and how we can become aware of when we need to use them. How we can accomplish more

things or change how we see (or hear) things, how we feel, how we think and how we act by using executive capacities to cue and direct our perceptions, feelings, thoughts and actions.

Increasing awareness of Personal Executive Strengths and Weaknesses – Also in tandem with the discussion of goals and how executive capacities work, discuss specific executive capacities that may be viewed as strengths of the child and discuss executive difficulties that lead to perceptions, feelings, thoughts and actions that are at the root of the problems that the child is experiencing. Shift the focus as quickly as possible to the kinds of perceptions, feeling, thoughts and actions that would be positive alternatives to the problems that have been identified, noting that these positive ways of perceiving, feeling, thinking and acting will be the focus of the things that the clinician will be doing with the child.

External Control Strategies

Structuring the Environment – Structuring the environment is a strategy that can be used to reduce executive capacity demands on a child that has not yet learned how to effectively use executive skills or how and when to use executive functions to cue and direct the use of these skills. Additionally, for some children with executive difficulties, the problems they encounter relate more to an inability to handle the number and frequency of the demands for the use of executive capacities more so than the engagement of individual executive capacities per se. Modifying the executive demands by structuring the environment and implementing consistent behavior management plans can greatly reduce the number of executive-related problems these children exhibit.

Structuring Time – As is the case with structuring the environment, providing aids for time management can greatly aid students who have difficulties self-regulating the use of the executive capacities of Sense Time, Estimate Time and Pace. Strategies include maintaining and posting consistent schedules for activities, using clocks and timers, and building time monitoring into activities.

Providing Prompts – External prompting for, or direct delivery of, self-regulation cues are perhaps the most widely used strategy for external control of executive function difficulties. Much of what is considered good teaching practice involves a great deal of prompting for and/or delivery of self-regulation cues. In some cases, the prompting process needs to be made a more concrete part of the child's environment in order to encourage performance of actions in the proper sequence for adequate work production. Such concrete prompts include making lists of the steps to be completed for a task, and the specific order of completion of the steps, posting to do lists where they are sure to be seen, or providing and checking homework assignment books.

Providing Rewards or Administering Punishments – Although the use of externally administered rewards or punishments can increase the likelihood of obtaining desired executive control outcomes, the use of rewards and punishments should be carefully planned and monitored for the reasons discussed earlier.

Pharmacological treatment – Psycho-stimulant medication use is a common form of external control intervention for ADHD symptomatology. Although the use of medication enables many children to demonstrate increased use of some self-regulation skills, it is likely a gross oversimplification to suggest that the medication is directly acting on the frontal lobe, executive components of the activated neural networks. In fact, some research suggests that psycho-stimulant medications are primarily acting on portions of the activated neural network located in

other parts of the cerebral cortex and/or subcortical regions (Hoeppner, Hale, Bradley, Byrnes, Coury, Lennie & Trommer, 1997; Hale, Hoeppner, DeWitt, Coury, Ritacco & Trommer, 1998; Hale, Fiorello & Brown, 2005). Whatever the specific brain mechanisms at work, the observable effects for children who benefit from the use of these medications very often is improved use of some self-regulation capacities, especially the Focus/Select, Sustain, Inhibit, and Modulate capacities.

Bridging Strategies

Reflective Questioning – Teachers, parents and clinicians (referred to here as mediators) can encourage children to engage executive capacities through the use of reflective questioning. A child who asks others for assistance rather than trying to figure out the answer to their question on their own or who is unaware of the need to ask questions to be an active learner and producer is not engaging the executive capacities needed for self-reflection. In situations where the child asks a question, reflective questioning involves the mediator repeating the question back to the child instead of providing an answer. In situations where the child seems unaware of the need to be asking questions for adequate engagement, reflective questioning involves the mediator asking the child a question that is intended to make the child aware of the need to engage executive capacities and to subsequently engage them. In either case, the child is being prompted in a more general way to try to identify and engage executive capacities to the extent possible in order to respond to the question that was posed to them. The responses provided by the child offer the mediator great insight into the effectiveness of the child's executive capacities once they are cued for activation in a nonspecific manner. After receiving a response from the child, the mediator should engage in the next strategy described here – providing feedback about the adequacy of the child's response.

Providing Feedback About the Accuracy of Performance – Feedback should be provided in as many situations as possible when a child attempts to engage executive capacities or in all situations when a child responds to questions designed to cue engagement of executive capacities. Providing immediate and frequent feedback about the effectiveness of performance, or feedback about the adequacy of responses to questions about performance, is perhaps the most effective means of increasing the likelihood of effective engagement of self-regulation capacities as well as a means for helping with the transition from external to internal control.

Modeling Appropriate Use of Executive Functions – Social modeling strategies are an effective means of helping children consciously or non-consciously engage executive capacities to self-direct functioning.

Teaching Specific Executive Skill Routines – Although applied primarily in cognitive strategy training approaches focusing on improvement of academic functioning, these techniques can be adapted to address executive difficulties in the intrapersonal, interpersonal, and environment arenas as well. As in the academic arena where the task is dismantled into its component pieces and the child is given explicit self-direction cues, (i. e., a plan of attack or action), to complete or accomplish the task, this same scaffolding can be provided for a child's interactions with others, awareness of self, or navigation of the environment.

Using Verbal Mediation – The capacity for generating internalized language is an extremely effective tool for improving self-regulation capacities. Cognitive Behavior Therapy (CBT) approaches are particularly effective examples of the use of self-talk to increase self-control.

Social story techniques also make great use of mediated language to generate changes in behavior.

Using Verbal or Nonverbal Labeling – This strategy involves the development of a common vocabulary or set of metaphors or a common set of nonverbal symbols or images representing cues for the engagement of executive capacities or for describing internal experiences. One of the significant strengths of many CBT-oriented approaches such as Ross Greene's collaborative problem-solving approach (Greene, 2001; Green & Ablon, 2006; Greene 2009) and Myrna Shure's I can problem solve (Shure, 1992; Shure, 2005) methods is the emphasis on developing a common vocabulary that can be used to describe the child's internal experiencing of perceptions, feelings and thoughts and linking these mental experiences to routines for behavior control. In the case of children who are more visually-oriented in their thinking and/or who have significant language impairments, nonverbal labels can serve a similar function (e.g., mentally picturing the image of a stop sign to represent the inhibit cue).

Practice and Rehearsal – The cognitive psychology literature on the development of expertise has made it clear that practice is the single best strategy for increasing proficiency. A child with executive difficulties will need to practice the use of the deficient executive capacities in order to become more effective in their application in a self-regulated manner. Practice also is the strategy most likely to accelerate neural growth, thereby helping to close the gap produced by maturational delays. Additionally, routines and the conditions in which they would be used can be rehearsed ahead of time to increase the likelihood that executive capacities will be used effectively in situations where they are required.

Aligning External Demands with Internal Desires – For many children with executive difficulties, directing externally demanded production is much more difficult to accomplish than directing internally commanded production. This observed fact can be capitalized on in situations where flexibility can be exercised with external demands. When possible, making externally demanded production requirements match internally commanded desires for production will increase the likelihood of the child's effective use of self-regulation capacities to achieve the desired outcomes.

Teaching Internal Control Strategies – Preparing the child to become self-regulated through the use of internal control requires the teaching of specific internal control strategies. These include ways to provide self-feedback (internal feedback), ways to select and self-administer rewards, and ways to self-monitor effectiveness and efficiency of executive capacity use. Some children with executive difficulties need assistance with learning how to generate and/or cue the use of internal perceptions, feelings, or thoughts or images of action to provide themselves with feedback about their perceptions, feelings, thoughts, or actions. Although many intervention approaches including CBT rely heavily on "self-talk" as a source for internal feedback, such feedback can come in the form of nonverbal processing of mental imagery.

Internal Control Strategies

Internal Feedback – Once learned, knowing how and when to talk to oneself or when and how to engage internal imagery to guide perceptions, feelings, thoughts and actions enables full internal control of self-regulation executive capacities and greater access to and control of other higher level executive capacities that are developing.

Self-Administered Rewards – Self-administered rewards are an effective way of self-aligning external demands with internal desires. Once learned and internally regulated, self-reward routines can be generated and used by the child to overcome resistance to, and to comply with, external demands for production and also to meet self-determined long-term goals.

Self-Monitoring – Self-directed monitoring of perceptions, feelings, thoughts and actions can ensure adequate production without any cueing or prompting from external sources. Once self-monitoring strategies have been learned and internalized, the self-regulated learner is able to recognize situations in which self-monitoring could be used and is able to cue and direct the effective use of self-monitoring strategies.