

EXECUTIVE FUNCTIONS: An Overview

DEFINITION OF EXECUTIVE FUNCTIONS

Executive functions (EF) are those abilities we use when we solve problems. They include the abilities to examine a problem, define it, decide upon a course of action, implement a plan, assess how well the plan is working, and take corrective action when necessary. We do things so automatically that we think of them, if we think of them at all, as taking place together, but such is not the case. One might decide to go shopping and begin almost automatically to carry out that decision, only to discover that one's keys are in some forgotten place. One has used various executive functions (mental abilities) to assess the fact that a product is needed, decide to go buy it, and head out the door, but executive dysfunction in one small part of the brain has thrown off the whole plan. One of the executive functions (*working memory*) did not work as well as the rest.

In neurocognitive disorders problems are caused by executive dysfunctions. Executive dysfunction due to problems in brain development or injury can lead to serious consequences. Communication, social functioning, school and career, and behavior can be expected to be impaired without normal executive functions. These, then, are what we must improve to pave the way for neurocognitive impaired individuals to reach their full potential.

Our executive functions have many components, all of which contribute to our understanding of the world around us:

- **Memory:** we remember similar situations and how we reacted to them in the past. For example, when faced with the prospect of crossing a road, we remember that we need to look both ways to check that there are no vehicles coming, and we remember that we need to listen for the same reason.
- **Inhibitory control:** the suppression of certain thoughts or fears that might keep us from reaching our goals. In the case of the relatively simple task of crossing the road, we suppress the fear of getting hit by a car. If we let this fear take over we would never reach our goals; i.e. the other side of the road.

- **Planning:** the ability to make a mental picture of how we are to reach our goals. We think of the road, we assess the potential obstacles that might stand in our way, and we decide how we are going to act.
- **Organization:** the ability to use a system to arrange our thoughts, such as organizing the different components of a challenging situation.
- **Time management:** the ability to evaluate the time restraints on any given situation - for example, how long should will it take to complete a task?
- **Metacognition:** the ability to consider ourselves in a more objective way - when tackling a problem we are able to evaluate its progress and give ourselves an idea of how we are progressing. A good example of this is the completion of tedious tasks. We have all been in the situation where we have had to face a physically but not mentally challenging situation, like moving a pile of bricks from one side of the garden to the other. We automatically evaluate how we are progressing: "I've moved around 20% of the bricks, so I have 80% left."
- **Self-regulation of affect:** meaning the ability to manage our emotions to control our behavior. Using the example of the menial brick-moving task, we manage the fact that it is an uninteresting task because we know that the goal must be reached.
- **Task initiation:** the ability to start a task with enough time in order to get it done. If we really do have to move a pile of bricks from one end of the garden to the other, then we are unlikely to start it at 8 p.m. because we know it would be unsafe to work in the dark.
- **Goal-directed persistence:** we can visualize our goals, and we have the ability to stay on course with our plans until those goals are met. It also means that we have the ability to forego any distractions that might come our way until the task is completed.

All of these components are present in the typical population, in varying degrees of importance. Some of these executive functions are stronger than others in some people. For example

some people may find themselves easily distracted while completing a task while others may have difficulty in realistically evaluating the time constraints.

EXECUTIVE FUNCTIONS AND NEUROLOGICAL DISORDERS

Extensive research has shown that the problems patients face with autism, ADHD, stroke, and traumatic brain injuries are due to actual physical underdevelopment or injury to the brain. Most of the difficulties they face are due to dysfunction of the part of the brain known as the frontal lobes, where most of our thinking takes place. This is not to say that these individuals are retarded—on the contrary, they may have normal or above average intelligence. But the ability to score high on a test of intelligence does not tell the whole story of how the brain is functioning. Individual parts of the brain have specific functions, and woe to the individual who lacks one of the many functions needed for communication, behavior, or cognition.

EXECUTIVE FUNCTIONS AND SOCIAL FUNCTIONING

When it comes to social functioning, two of the most important executive functions are our working memory and our inhibitory control. Our working memory lets us hold a picture in our mind of the ultimate goals while doing other things. For example we can remember where we put our keys (most of the time), and we can remember to buy bread on the way home from work if we run out at breakfast.

Our inhibitory control allows us to put restraints on ourselves and not succumb to thoughts or impulses that may render us socially unacceptable or even get us into trouble – like losing your temper when you cannot find your keys, or not paying for the bread at the store. We can evaluate the consequences of our actions, and make sure that negative consequences do not happen to us.

Assessing Executive Dysfunction

There are a number of different tests that are widely used to check for the possibility of executive dysfunction in children. The usual course is that people closest to the child (such as parents or teachers) identify key traits in the child that may be linked to executive dysfunction, such as a short attention span or the inability to complete simple tasks despite a normal level of intelligence. From a parent's standpoint, concern is often raised when the child is observed to be unable to regulate his or her behavior in common situations. The next step is to consult with a neuropsychologist.

Remedies for Executive Dysfunction at Home

For the majority of us executive functions are automatic and require very little thought (take the earlier example of crossing the road). For a child with executive dysfunction, however, it can be a difficult path.

Typical schooling assumes that the executive functions are already present in the child. This is normally why children with executive dysfunction struggle in a normal school environment. In fact, the best place for executive function training to take place is usually within the home, using normal everyday activities as a training tool. When presented with a particular task within the home, the child should be asked to assess how difficult he feels the task will be and why. This encourages the child to think about all possible outcomes, and helps to identify any obstacles or barriers that might arise. Throughout the task, asking the child how he or she is doing encourages more thought into its completion, and when the task is complete, asking the child to assess his success will give him the motivation to evaluate his performance.

A simple example of this sort of task is asking the child to put all his toys away. The goal has been presented to the child, and the parent can guide the child along the logical steps to achieve that goal. There is an obvious path to completion of the task, and the parent must ensure that the child is taking the correct steps in the correct order, and understands why he has made the decision to follow those steps:

- Goal: what am I attempting to complete?

- Plan: how am I going to do it? What other things do I need to complete it?
- Prediction: is this task easy or difficult? What will be the eventual outcome?
- Do: what problems do I encounter on the way? How do I solve these problems?
- Review: how well did I do? What was the best method? Is there anything I did that I can improve upon next time?

In his groundbreaking work Vygotsky discovered that children do better at a task with adult mediation than on their own. This led to the idea of the adult as a mediator of cognitive skills, or a collaborator, rather than as a storehouse of information. The mediator serves as the child's consciousness, constantly evaluating the task, rather than as a human instruction manual.

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