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Improving Executive Function In Children with Autism Spectrum Disorders



What is Executive Function?

Babies and little children typically react to any stimulus they encounter in a manner that is impulsive, concrete and present-oriented. They have not yet developed organized play and so they engage in a kind of sensory "muck-about", going from one stimulus to the next, impulsively putting their hands in things and putting things in their mouths. Their play is often disorganized and repetitious.

As children develop, however, they are increasingly able to think about multiple aspects of a problem, plan a course of action, hold that plan in mind and act upon it. They also gain the ability to discern that something is an error and to modify their actions based on learning from errors. As very young children grow, they are more and more able to engage in organized, planned, goal-directed actions.

Goal-directed activity depends on a number of mental processes, including organization, inhibiting impulses, selective attention, sustaining, shifting and planning memory. The ability to engage in goal-directed activity, along with the mental processes that make this possible, fall under the heading of executive function (EF).

Problems with executive function are neurological in nature and are thought to arise from a disruption or delay in normal neurological development. The pre-frontal cortex is considered to be largely responsible for executive function skills, but many parts of the brain have to "network" for successful executive functioning to take place.

Executive Function and Autism

During the in the 1990's, research on executive function examined the connection between autism and EF. In 2004, Elisabeth L. Hill summarized that research, concluding that, although many children with autism do have difficulties with executive function, it cannot be considered a defining feature of autism because there are also children on the autism spectrum who do not have difficulties with executive function. As a result, autism treatment has largely excluded assessment and treatment for EF and focused instead on the social and communication difficulties common to all individuals on the autism spectrum.

Not all people on the autism spectrum have EF problems. But many do.

The tendency to ignore executive function in autism treatment has had significant implications for those individuals on the spectrum who do have difficulties with EF (estimated to be as high as 80%). Many of these individuals do not progress well with social and communication issues without also addressing their difficulties with executive function. Unable to progress with teaching methods that do not take their EF problems into account, they may be incorrectly classed as more profoundly or severely autistic or as both autistic and mentally retarded. The problem is not mental retardation or more severe autism but autism combined with problems in executive function.

For some individuals, social and communication difficulties are not the primary issue. In the Growing Minds Program, we have worked with children diagnosed with autism who are socially engaged, have good eye contact and are doing their best to communicate frequently. But they are unable to respond in a timely and organized way to the requests of parents and teachers, or to organize and initiate sophisticated play, because they have considerable difficulty with executive function.

While obtaining a valid definition and theory of autism is an important goal for research, the work of the Growing Minds Program is focused on helping children. As a result, we are not concerned with determining which difficulties may be features of a broad disorder called autism, but with a particular child who may need treatment planning that takes into account many possible strengths and deficits. Some of these may or may not be a fundamental part of autism. For instance, some children diagnosed with ASD have executive function difficulties, some have movement problems (dyspraxia), some have speech apraxia and some children have overlapping difficulties.

Executive Function and Movement Problems (Dyspraxia)

There is often an overlap between <u>dyspraxia (motor control problems)</u> and EF problems. However, some children with motor problems can organize themselves very well to accomplish complex goals

within their motor limitations and do not show indications of EF concerns. Other children with obvious EF problems appear to be motorically adept. (Although closer observation may uncover more subtle motor organization problems.)

All these individuals make the best progress when teaching methods are designed to accommodate their specific challenges. It is important to assess each person as an individual so that teaching methods will be effective for that person. In the Growing Minds Program, we do our best to assess for dyspraxia issues, as well as looking at the umbrella of executive function and the processes involved with it.

Intelligence Has No Correlation with Executive Function

Executive function difficulties can be a little like having a computer that has good programming and good files with a compromised "output" device. The printer is not working and the monitor is on the blink. A child may be quite intelligent, but have undeveloped executive function. When this happens, the child will receive very low scores on intelligence tests. When EF is improved, the child is more able to be assessed and will test at a higher level. Many children are smarter and more capable than they appear, and when their executive function is improved, they can begin to show their abilities to greater advantage.

Identifying Possible Executive Function Difficulties in Your Child with Autism

Here are areas that may suggest that a child has some degree of executive function difficulty.

Organization

We use this term to refer to the child's ability to produce a timely, organized response, when requested to do so. There are many children with ASD who demonstrate physical actions spontaneously but who do not perform the same actions, in a timely way, when asked to do so by another person. For example, a child quickly puts on her shoes when she wants to go out, but she does not put them on (or takes a very long time to do so) when asked. Often this is interpreted as a problem of cooperation or motivation, but it can also be an indicator of EF problems. She may be unable to organize the steps of the action in time to follow the request, even though she is physically capable of performing that action.

Children with these problems have difficulty organizing and remembering the steps to complete a task. Even simple activities typically require a series of steps in order to accomplish the goal.

For example, in a simple matching exercise, the child is asked to match an item to the identical item (from a group of 3 different items) on the table before him. In order to complete this task, he has to look at the item being presented, register and remember what it is, then look at the array of three items on the table. Then he must identify the item that corresponds to the remembered item. Then he has to reach out, take the matching item and put it with its "mate" on the table.

There are some children who "lose the plot." They forget to look carefully at the match item. They take the presented item and place it randomly. They have a certain number of correct responses and a number of incorrect responses, because they stop using their eyes, their minds and their hands in the proper order to successfully do the job. Observers may tend to interpret the incorrect responses as a problem with understanding (the child does not know which items match) or with cooperation (the child is not motivated). But it can also be a problem in organization, indicative of EF difficulty.

Impulse Control

Some children with ASD simply cannot control their impulses sufficiently to participate in structured situations. Often, they cannot remain seated long enough to complete a teaching session. Instead they repeatedly stand up and go toward whatever has caught their attention. If impulse control is a problem, children will be unable to manage impulses to grab, pinch, hit, bite, put things in their mouths and run away. These impulses can confound the child, frustrate parents and disrupt efforts to teach.

Planning Memory

It can be difficult to assess planning memory in some children who are not functioning well. In children with midrange functioning, we may see them appear (at times) to forget the sequence of events necessary to accomplish a task, even when they are highly motivated. If asked to get two different items and give them to the teacher for a piece of beloved chocolate, the child presents only one item and forgets the other.

Attending

This is also referred to as selective attention. Recently, we worked with a child who could label one item if it was held up. He would look at it and say what it was. If he was asked to point to the same item on the table among an array of three items, he could not name it successfully. He had trouble attending to what he was asked to attend to, when he was asked to attend to it and he had trouble using his attention to compare items for discrimination. There can be a variety of problems with selective attention.

Sustaining

Many children have difficulty sustaining activity and can only sustain good performance for a short time. For example, if a child has 10 math problems, the last 6 will generally be wrong or left unfinished, but the first four will be correct and done perfectly.

Shifting

Many children with ASD have trouble shifting into a different activity. If a child has not spoken in a while, he has difficulty starting to speak. If she is sitting on the floor and is asked to come to the table, this takes a great deal of time and effort. He has trouble transitioning from one activity to another, even when he prefers the second activity. If given 10 math problems, the child may get the first several answers wrong because she has not shifted into the way of thinking and performing needed to do the task. But the last 6 problems may be correct because she knows the material once she has made the shift.

Initiating

Some children learn to play a repertoire of different games and activities. They can play these games independently but they will not initiate them. Even if they are obviously bored, they will still rely on others to initiate all of their organized activities.

Emotional Control

Many children with autism appear to "act out" every feeling "times 10". It does not appear that there is a problem with unexpressed feeling. Children have to learn that not every emotion need be expressed or acted out. The ability to feel emotion without enacting it is related to EF. If your child knows that some very desirable activity, such as watching a favorite TV show, will not be available if he has a tantrum, and yet he still has the tantrum, you might suspect a difficulty with emotional control. Even though he wants to control his emotional expression, he is not able to do so.

Motor Control

Certain sophisticated forms of motor control are related to executive function. Complex sequences of motor actions, multi-step processes and actions requiring greater levels of sophistication can be confounded by difficulties with sustaining, impulse control, attending to targets, etc. For many children, activities like choreographed dancing, yoga, martial arts or organized swimming can help

improve executive function. Impulsive and chaotic activity does not help EF. For example, free swim does not do the job. But swimming where the child is asked to use the breast stroke for one lap, and then use the back stroke for one lap will exercise executive function skills.

What can help?

There may be as yet undiscovered biomedical interventions that may help children to develop greater executive function. Until that is discovered, we rely on "activity dependent plasticity" to improve EF. This is the principle that the brain adapts to the demands that are placed on it.

The nervous system is more changeable or "plastic" than was once thought. New scanning technologies like PET, CAT, MRI, and Functional MRI have taught us that the brain and nervous system work more like muscles. New demands placed on the nervous system, if done with high frequency over a period of months, can elicit adaptations in the nervous system.

If a child has trouble shifting, shifting may become stressful for the people around that child. Over time, they may come to avoid asking the child to shift or they may lead her carefully through shifts, doing the work for her, to avoid difficulty. Over time, she gets fewer opportunities to practice and shifting becomes even harder. But if that child can be helped to make shifts successfully dozens of times a day for months, there is a possibility that the nervous system will compensate or adapt to the demand.

If a child has not been successfully organizing responses to requests more than a few times a day, and then he is helped to learn to produce hundreds of responses on request, on time, every day for months, there is a possibility of changing the brain of that child.

Discrete Trial Teaching

People do not learn without learning opportunities. Discrete trial teaching is a method that provides ample opportunities to practice EF skills. A "trial" consists of a clear request, a pause, a prompt if necessary and reinforcement for a successful response. Each trial is an opportunity for the child to produce an organized response and to practice shifts. During good discrete trial work, children also practice controlling their impulses.

In some programs, we use a "clicker" to count the number of trials that a child gets in a day. If the child has executive function difficulties, we would like to provide five hundred or more trials per day. When children with EF problems do not have enough chances to practice, they often reach a "plateau" in their development.

Enjoyable Fast Trials and Mixed Trials

With many children who have executive function difficulties, we introduce fast trial work, based on the work of Vince Carbone. While researching intertrial speed, he noticed that when the speed is very fast, many children with ASD have less disruptive behavior, produce more correct responses and sustain longer. In our work, we have also found more indications of happiness from the child during this form of work, along with more requests from the child to do the work. Over a period of months, this type activity brings increases in overall executive function, particularly in fluency, efficiency, speed of output, fast shifting and information processing.

Fast trials usually involve skills that the child has already mastered. There may be imitation trials, identification trials and expressive labeling trials. These trials are mixed and done in rapid succession. In our work, we often do 90 second stints. These stints often involve 40 to 60 trials. The child and the adult shape up speed together.

This accomplishes several things. In four 15 minute sessions per day with a skilled teacher, the child can get hundreds of trials. That is a tremendous opportunity for the child to practice organizing responses on time and on request. Because the trials are mixed, there is a sizeable amount of shifting. As the child gets better at responding, sustaining is built. Selective attention is fully exercised. There

is actually no time for impulses, so the child has the experience of working without being hampered by impulsivity.

Many children with EF problems enjoy working fast. We believe that they may be thinking faster than they are performing. When they are helped to perform as fast as they think, they are more in tune with themselves and can take some pride and satisfaction in what they are doing. The key is that child has control of his responses. For instance, fast scribbling is not helpful and is often a product of poor impulse control. Fast and accurate responding is controlled and it demonstrates fluency.

Implications for Therapy and Instruction

An understanding of executive function can be very useful when teaching a child who has difficulties. For example, if a child is sitting comfortably, leaning back on a couch and is asked to "Come and sit at the table," the child may not move. This could be a shift problem. It is a very large shift for the child to get from that lounging position all the way to the table. However, if you recognize this as a "shift" challenge, you can help by changing the request. Ask the child first to "Stand please." Once the child is standing, ask him to "Come and sit at the table."

Shift problems are often misinterpreted as a lack of cooperation, lack of motivation or reluctance to respond. However, when the shift is broken into steps, some children suddenly perform the shift with no other changes in method! Shift challenges can also be helped with visual schedules, visual timers, warnings and "count downs."

Some children are so disorganized in their functioning that they make a lot of errors. This can be true even when a child thoroughly knows the material. Imagine that a child knows the exact names of 50 common items. But when shown three pictures, and asked to "Show me the (named item)," he does not respond correctly. An unusually detailed observation can discover whether the child is not listening for an instruction, or not looking to find the item in the array and or not moving to point to the item. On some occasions, the child doesn't look at all, but points to the picture that he was already looking at, or he is beginning to point even before he hears an instruction. Can that child be prompted to listen first, then look, then reach? Yes.

For example, sometimes we use a "screen." We cover the array with a piece of cardboard. We first get the child's attention, and name the requested item before all the pictures become visible. Then we remove the screen, and let the child point. Some children increase from 33% correct responses in an array of three (chance level) to 100% correct, with the simple use of a screen.

Helping Children with Autism to Improve Competence

In the above examples, the problem was not that the child didn't understand the instruction, didn't know the answer or was reluctant or unmotivated. Each child had profound difficulties functioning, even when they had the knowledge and cognitive ability required to do the task. In some programs, children are required to do the same tasks over and over until they get 90 to 100% correct responses. For children who know the answers but have profound difficulties functioning, the cognitive level of the material is so low compared to their comprehension, that the work can be brutally boring. This results in motivation problems on top of functional difficulties.

The shift and organizational problems described above are only two examples where basic executive function difficulties can profoundly affect your child. There are dozens of other ways that a child can be affected and there are many ways that specialized teaching methods can help a child begin to truly demonstrate his or her actual cognitive ability.

If your child is not responding, or not responding well, it is important to get past common assumptions about his or her difficulties. Observe with a much more careful eye and observe every

aspect of your child's response in detail. Some people refer to this as a "micro analysis" of the child's functioning. Take into account the idea that your child may be having difficulty with certain basic functional and organizational skills. Your child may actually know more than he or she is functionally able to show at this point-- because of EF difficulties. Good practice of effective functioning on a daily basis can dramatically improve your child's competence over time.

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i There are different kinds of "shifting" that are of concern when looking at executive function. The term shifting is often used to refer to circumstances where a student begins an activity in which they are following one set of rules, and has to shift to a different set of selection criterion. In students with more profound executive function difficulties, we see problems with even the simplest transitions.

ii I have listed some basic EF skills in what I hope is an easy to understand format. There are a number of ways to identify and categorize EF skills. For people who are interested in more detailed categorization, we utilize the format suggested by Peter Anderson in his article "Assessment and Development of Executive Function (EF) During Childhood" Child Neuropsychology 2002, Vol. 8, No. 2, pp.71-82. This organizes EF skills into four sub-categories: Attentional Control, Information Processing, Cognitive Flexibility, and Goal Setting. Each of these categories is an umbrella term for several skills.

iii EF involves developing goal oriented behavior. In a discrete trial, a student performs an action in order to obtain a result. Instead of simply grabbing a treat, the child is told to perform an action in order to receive that treat. In effect the student is given a goal, and a method to achieve that goal. Each discrete trial is a mini episode of executive function.

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