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Where are Executive Functions hidden? Some Tips on Evaluating Measures

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Executive functions, as key cognitive skills for learning and adaptation, need to be observed and measured by specific reports and performance-based tasks.

When do children use executive functions?

Executive functions are a set of cognitive skills which enable children to plan, focus, remember guidelines, and manage multiple tasks successfully. The three core executive functions include: working memory/updating, inhibition and cognitive flexibility (Miyake *et al.*, 2000). Children use these three core executive functions to complete everyday activities, especially novel tasks in which going automatic would be insufficient. When executive functions work in concert, they allow children to solve these problems and achieve their learning goals. For example when solving a specific task such as comprehending a written text, children are able to keep in working memory the information from previous paragraphs and sentences and integrate it later with new information, but also inhibit any distractors that could interfere with their understanding of the text (Berg *et al.*, 2020). Some children experience challenges or delays related to their executive function skills and as a consequence experience difficulties in various school tasks (i.e. difficulties to maintain the rules and the information in memory or to update them or even change perspective). Such challenges can be prevented and supported by monitoring, screening and intervening in executive functions from early childhood.

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Why measuring executive functions?

As mental processes, executive functions are not directly visible in learning and adaptive behaviour, neither when everything goes well nor when there are difficulties. Therefore, especially in the latter case, it is important to be able to identify them behind the manifested behaviour in order to be able to support and strengthen them with intervention programmes. Overall, when measuring executive functions practitioners can find answers to the following questions:

- 1) *What are the executive function challenges that the child has?*
- 2) *Which executive functions are required for the problem/task we are asking the child to solve?*
- 3) *How can we help him/her to overcome these challenges?*

How to measure executive functions?

Executive functions in children can be measured in two main ways: by –

1. Adult reports
2. Performance-based tasks.

Adult reports are measures that are used by parents, teachers, and other caregivers to report on children's executive functions in the context of their everyday environments (McCoy, 2019). These reports include a list of behaviour-related questions about the children and the answers rate the frequency with which children demonstrate common challenges with executive functions. An example of an adult report measure is the Behavioral Rating Inventory of Executive Functions (BRIEF' Gioia *et al.*, 2000). BRIEF contains questions which are answered by the respondents via Likert-type format with 'Never', 'Sometimes', or 'Often'. The reports compiled by the adults make it possible to draw a profile of the child's executive behaviour in order to highlight areas of strength versus areas of weakness in

attention, inhibitory control, emotive regulation, time and material management, action planning and monitoring, and use of working memory. Being observation-based, they are very ecological and can be used to plot a change curve (because they have no limits on the number of administrations). However, they are very dependent on the eye of the observer and may therefore encounter linguistic and cultural limitations.

Some example of items included in the BRIEF measure:

- *The child is unaware of how his or her behaviour affects or bothers other.*
- *The child has trouble putting the brakes on his or her actions even after being asked.*
- *The child becomes upset with new situations.*
- *When given two things to do, remembers only the first or last.*

Since adult reports are based on qualitative and subjective observation, they are not sufficient to understand executive control processes and if specific difficulties in each of these processes. Thus it is very important for the teacher or parent to seek in-depth psychological counselling. The psychologist can measure the different executive functions with performance-based measures as in the following examples.

Performance-based measures include various tasks that are administered directly to children either one-to-one or in a group setting to assess a specific executive function. For example there are specific tasks which measure the ability to update information in the working memory such as the **Listening recall task** (Pickering & Gathercole, 2001), in which children listen to a series of short sentences and after each one they have to say whether each sentence was true or false. After the series of sentences has been presented, children have to recall the final word in each sentence.



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Other frequently used tasks are the **Eriksen Flanker Task** (Eriksen & Eriksen, 1974) used to measure the ability to inhibit dominant and automatic response. In this task, children are shown a row of five stimuli, and have to make a response based only on the central/target stimulus – in other words, they need to ignore the flanker stimuli (e.g. “LLALL”, where the central letter A is the target stimuli). This task includes three different types of trial: neutral trials, compatible trials, and incompatible trials. In all three conditions, the target letter is flanked by two distractors on each side.

A frequently used task to measure cognitive flexibility is the **Wisconsin Card Sorting Test** (WCST) (Milner, 1964). This task assesses children’s ability to consider a number of different ideas or perspectives at one time, and to actively switch between them. Children are required to sort cards according to one of three dimensions: colour, shape, or number. Children are not told the dimensions, but they receive feedback regarding whether or not each card was correctly sorted. The dimensions change after ten consecutive trials, after which children need to work out the new dimension that they should be matching for.

Practical tips

- Measuring executive functions can help practitioners understand challenges that children may have with these skills.
- Results derived from the measuring of executive functions can help practitioners develop programs to improve these skills in children.
- While performance-based tasks are mainly administered to children by licensed psychologists, adult reports can be administered by teachers and parents of children.
- It is recommended that factors such as home and school environment as well as socioeconomic status are also taken into account when examining executive functions in children.

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