

# Improving Executive Functioning and Short-Term Working Memory in Children with Down syndrome (birth-5 years)

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## Abstract

Executive functioning skills such as short-term, working memory are particularly difficult for those with Down syndrome. Recent research suggests executive functioning skills can be targeted in early development to improve cognition and language skills.

This presentation demonstrates several strategies to target short-term working memory in children with the diagnosis of Down syndrome.

## Summary

It is well documented that people with the diagnosis of Down syndrome have difficulty with executive functioning and short-term, working memory. However, little has been documented to demonstrate how to improve this skill in children five years of age and under with Down syndrome compared to children with other intellectual disabilities. The three main components of executive functioning are: working memory (holding and manipulating information in mind), inhibition (self-control - resisting temptations and resisting acting impulsively and selective attention - focusing on relevant input and ignoring distractions) and shifting (cognitive flexibility, being able to adapt to changing requirements of a task). These underpin higher order executive functions, reasoning, problem-solving and planning [8, 16]. Numerical sequencing has been used in some studies with moderate success demonstrating short term working memory can be improved; however, not many other strategies are suggested for younger children. Targeting this skill has also been thought to improve overall language skills by helping those affected retrieve language faster and more efficiently for daily activities. Researchers have even gone so far as to predict later language abilities based on how well young children perform short-term memory tasks.

The literature also suggests young children begin developing executive functioning skills in the first year of life through the manipulation of their environment. One longitudinal study suggests children who develop mastery motivation well at age three have better language skills at age 23 [12]. Therefore, it is logical these skills should be targeted in early childhood development in the home and in specific therapies children receive. Research is also becoming more focused on the phenotypical characteristics typically demonstrated by those with the diagnosis of Down syndrome [11]. These characteristic behaviors and skills are important for therapists and families to know to better teach our young children skills of daily life and skills required in educational settings. However, knowing the characteristics and relative strengths and weaknesses of most children with Down syndrome does not always lend to knowing how to target desired skills and behaviors. It is also well known that young children with Down syndrome have greater difficulty with expressive language and imitating speech sounds and verbally requesting (Chapman, 2006). Targeting both executive functioning skills and expressive language will best help children with Down syndrome improve overall language and cognitive abilities.

## Strategies

Given the inherent strengths (visual learning and receptive language) and weaknesses (executive functioning for working memory and expressive speech and language) of children with Down syndrome, this poster session demonstrates several strategies that can be used in the home and therapeutic settings to target and improve executive functioning and working, short-term memory skills. These strategies utilize both visual and auditory memory skills.

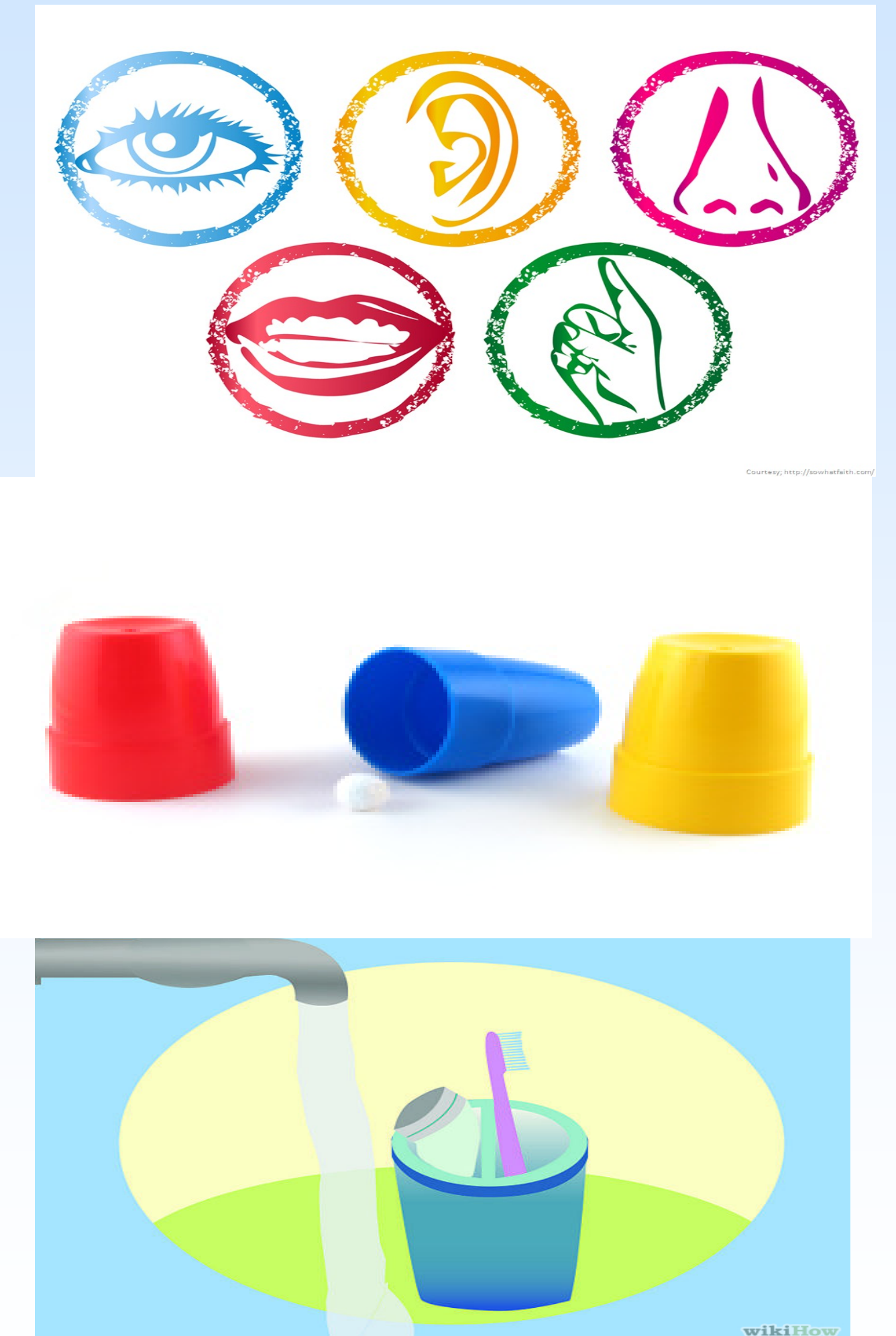
1. The first activity involves asking the child to locate and point to their body parts then asking them to do so in sequences of two and three such as "touch your eyes then your ears, "touch your ear, nose, and tummy." This activity uses a skill the child probably already has (pointing to body parts) and uses sequencing to monopolize on auditory short-term memory.

Other activities involve visual aspects to help guide a child's memory.

2. Objects or pictures can be used in sequences of two to 6. When using pictures, sets are shown to the child in a row and labeled. If the child is verbal he/she can repeat the word after the presenter or can sign the word if non-verbal. The presenter then turns each picture over (the back is blank), waits up to 5 seconds and asks the child to locate the picture named. The presenter stops when the child is unable to locate the pictures named. If a child can remember three cards at 100% accuracy, but not 4, the child is thought to be processing information in up to three units. The literature also suggests this number is also strongly correlated with mean length of utterance (MLU). The same task can be used with objects by covering them up after they are labeled in a certain order. The child has to remember where the object is when hidden (using a cloth, cup, etc.) then respond to the auditory directions without visual information. Unlike number sequencing used in some studies, pictures and items are more a part of a young child's environment and more likely to be engaged with. In addition, color sequencing or pointing to multiple items in a child's visual space as well as the concept of object permanence with items such as different color cups and a ball also increase working memory.

3. Strategies can be made easier by adding a "First, Then" visual directive or more difficult by adding in wait time or using distraction tactics. These same strategies can be used in home environments when playing games, doing chores, and engaging in routine activities such as teeth brushing.

## Sequencing



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