

## Neuroscience Considerations for Addressing Cognitive Skills in Children with Autism Spectrum Disorder

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### Neuroscience findings in ASD

- Difference in cellular function (Goh et al., 2014)
- Atypical brain development involving multiple brain areas (Foster et al., 2015)
- Atypical formation of neuronal networks (Just et al., 2012; O'Reilly et al., 2017)
- Impairments of integration of complex stimuli (Baum et al., 2015)
- Differences in information processing (Denisova et al., 2016)

### Neurological Difference Impact

- Sensory perception and processing (Baum et al., 2015)
- Motor skills (Torres et al., 2013; Travers et al., 2016)
- Communication and social skills (Supekar et al., 2013)
- Anxiety (South & Rodgers, 2017)
- Cognition/cognitive control (Freeman et al. 2017)

### Cognition Needs in ASD

- Working Memory
  - Mixed findings (Wang et al., 2017)
- Executive Functioning
  - Likely related to social isolation (Freeman et al., 2017)
- Attention Management (Switching and Selective) (review in Pasiali et al., 2014, JMT)
- Cognitive Flexibility

### Why Music Therapy?

Music used in music therapy can be:

- Highly predictable
- Motivating & engaging
- Organizing
- Multi-sensory

### Sensory awareness and arousal

- Using music for sensory preparation:
  - Increase arousal
  - Decrease arousal
  - Reorganizing exercises

## Working Memory

- the skill that focuses on memory-in-action: the ability to remember and use relevant information while in the middle of an activity
  - connected to intelligence, information processing, executive functions, comprehension, and learning
  - working memory may be better facilitated through different material presentation (i.e., visual aid) (Cowan, 2014)

## Attention

- the ability to focus on a selected stimulus, sustaining that focus, and shifting it at will
- the ability to concentrate (Sanders et al., 2008)
- 3 attention processes: sustained, selective, switching (Posner et al., 2012; Posner et al., 2014)

## Executive Functions

- the processes that enable us to plan, focus attention, remember instructions, and juggle multiple tasks successfully (Barendse et al., 2013; Kenworthy, Yerys, Anthony, & Wallace, 2008)
  - Management of cognitive processes
  - Connecting past experiences with present
  - Used in planning, organizing, inhibition, strategizing, attending, and remembering

## Cognitive Flexibility (Sanders et al., 2008)

- The ability to respond to environmental changes
  - Types of experiences
  - Structure of experiences
  - Changes in rules, routine, or predictability

## Impact on Communication and Social Skills

- What are the components required for language development?
  - Cognitive precursors: attention, sequencing, working memory
  - Motor skills necessary for verbal and nonverbal demonstration
- What are the components required for socialization?
  - Cognition: attention, cognitive control, working memory, executive functioning
  - Communication: cognition, theory of mind, motor control for verbal and nonverbal exchange
  - Sensorimotor: processing information in the environment, motor control, etc

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