

- If you are viewing this course as a recorded course after the live webinar, you can use the scroll bar at the bottom of the player window to pause and navigate the course.
- This handout is for reference only. Non-essential images have been removed for your convenience. Any links included in the handout are current at the time of the live webinar, but are subject to change and may not be current at a later date.

© 2018 continued<sup>ed</sup>® No part of the materials available through the continued.com site may be copied, photocopied, reproduced, translated or reduced to any electronic medium or machine-readable form, in whole or in part, without prior written consent of continued.com, LLC. Any other reproduction in any form without such written permission is prohibited. All materials contained on this site are protected by United States copyright law and may not be reproduced, distributed, transmitted, displayed, published or broadcast without the prior written permission of continued.com, LLC. Users must not access or use for any commercial purposes any part of the site or any services or materials available through the site.

## Technical issues with the Recording?

- Clear browser cache using [these instructions](#)
- Switch to another browser
- Use a hardwired Internet connection
- Restart your computer/device

## Still having issues?

- Call 866-782-9924 (M-F, 8 AM-8 PM ET)
- Email [customerservice@OccupationalTherapy.com](mailto:customerservice@OccupationalTherapy.com)

continued

# Interoception: The Hidden Sensory System

Rondalyn V. Whitney, PhD, OTR/L, FAOTA

1

continued



2

continued

## Learning Outcomes

- 1) Describe key concepts related to the interoceptive system
- 2) Recognize the function-dysfunction continuum within the interoceptive system
- 3) Articulate intervention strategies to improve sensory processing and integration of the interoceptive sensory system

3

## Review of Ayre's Sensory Integration Theory

- Postulates that adequate processing and integration of sensory information is an important foundation for adaptive behavior.
- In sensory integrative dysfunction the brain does not process or organize the flow of sensory impulses in a way that gives the individual precise information about him/herself and the world.
- Somatosensory refers to the body and the senses together and can be used synonymously with sensory motor or sensorimotor.

4

## The Five Senses + Three

### The five senses

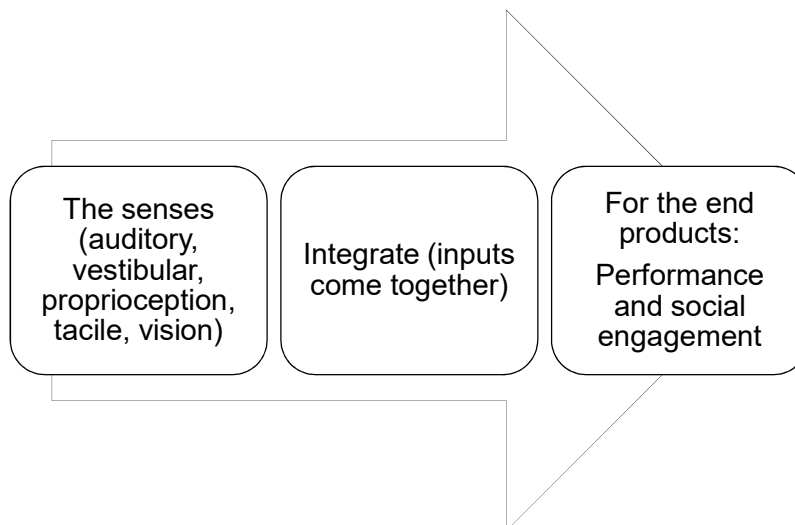
Seeing (vision)  
Hearing (auditory)  
Touching (tactile)  
Smelling (olfactory)  
Tasting (gustatory)

### Plus three

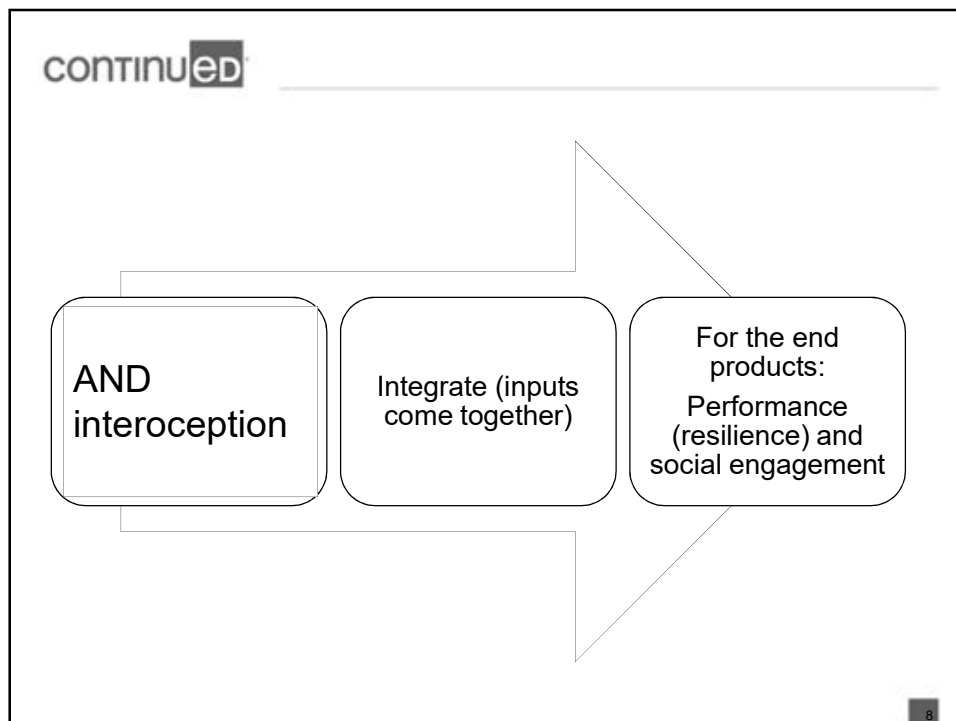
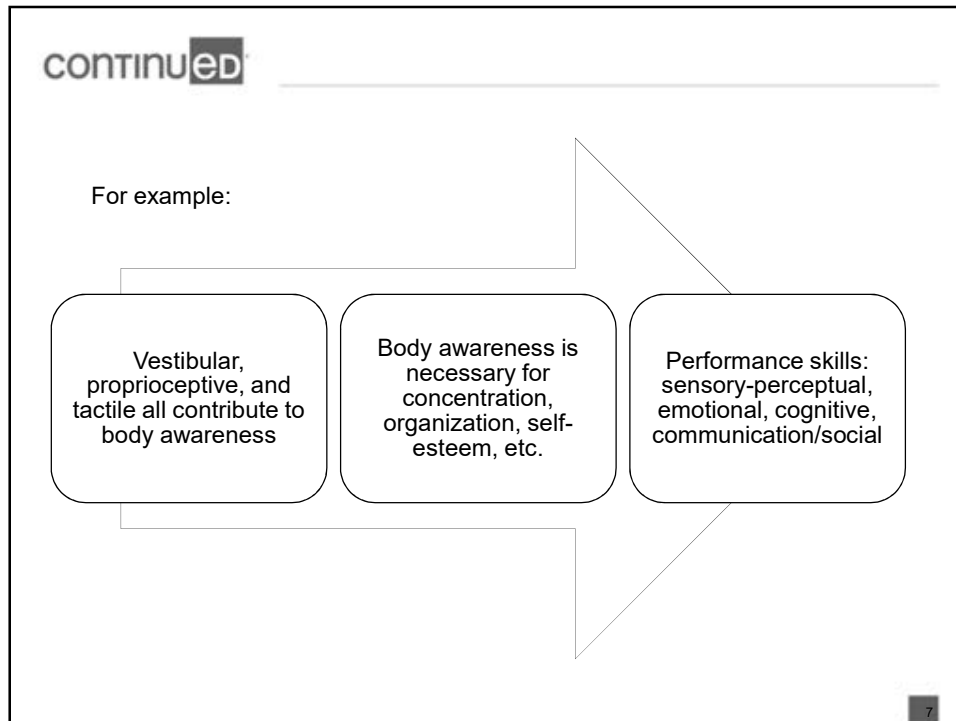
Proprioception (position orientation)  
Vestibular (spatial orientation)  
Interoception (internal organs)

[Need to mention: Praxis/Kinesthetic(movement orientation)]

5



6



continued



The drive to engage in occupation is the mechanism through which children develop skills and competencies

9

continued

## Core Elements of Sensory Integration Intervention Process (fidelity measures)

- Therapist's Behavior and Attitude
- Provide just-right challenges
- Collaborate on activity choice
- Guide self-organization
- Support optimal arousal
- Create play context
- Maximize child's success
- Ensure physical safety
- Arrange room to engage child
- Foster therapeutic alliance

Parham, L. D., Cohn, E. S., Spitzer, S., Koomar, J. A., Miller, L. J., Burke, J. P., et al. (2007). Fidelity in sensory integration intervention research. *American Journal of Occupational Therapy*, 61, 216–227.

10

## Why Sensation is Important for Learning

The brain learns best when aroused to attend to the learning opportunity.

If an internal sensation is demanding priority, we are not available to shift (move on from our internal need) to the external demand being placed upon us and so we miss out on the teaching.

11

## Postulates of Sensory Integration Theoretical Base

1. An optimal state of arousal is a prerequisite for adaptive responses to occur.
2. Sensory integration occurs during adaptive responses.
3. Multiple sensory systems may be needed to facilitate an optimal state of arousal.
4. Adaptive responses must be directed toward child's current developmental level.
5. Activities that reflect "just right challenge" produce growth and development.
6. Problems with sensory modulation or in foundational abilities contribute to deficits in end product abilities.

12



## Postulates of Sensory Integration Theoretical Base (cont.)

7. Child needs to be self-directed, with therapist guidance, for sensory integration to occur.
8. Adaptive responses are elicited through activities that facilitate sensory modulation, discrimination, and integration resulting in improved postural control, praxis/ bilateral integration, and participation.
9. Intervention is directed to underlying deficits in sensory modulation, discrimination, integration, and/or foundational abilities and not toward training in specific skills or behaviors.
10. As child achieves increasingly complex adaptive responses in therapy, changes will be evident in outcome abilities such as self-regulation, self-esteem, social participation, academic performance, and participation in daily life routines and activities

13

### Atypical sensory processing may present as

- Poor sleepers
- Poor eaters
- Hard to soothe
- Unresponsive to others

*Or by*

- Using less than optimal strategies in an attempt to regulate their arousal state (hand flapping, rocking, head banging)

14

## Function-Dysfunction Continuum

### Function

1. Optimal state of arousal
2. Adaptive response to sensation
3. Multiple sensory systems working together
4. Adaptive response at child's current developmental level
5. Able to tolerate frustration when given age appropriate tasks
6. Adaptive sensory modulation, age appropriate end product skills

### Dysfunction

1. State of arousal not optimal to support adaptive response
2. Maladaptive response to sensation
3. One or more sensory system out of sync with the others= non-optimal state
4. Immature adaptive responses
5. Poor frustration tolerance, avoidance strategies
6. Maladaptive sensory modulation, delays in age expected end product skills

15

## Function-Dysfunction Continuum

- |   |    |   |
|---|----|---|
| 7. Child self-directed                        | ←→ | 7. Delays in independence                                       |
| 8. Participates in sensory activities         | ←→ | 8. Avoids sensory based play                                    |
| 9. Age appropriate development                | ←→ | 9. Developmental delays (underlying sensory-motor)              |
| 10. Tolerates increasingly complex challenges | ←→ | 10. Maladaptive responses to daily life routines and activities |

16

## Case: Winnie

**Winnie** is a 9-year-old girl with challenges in sensory processing and sensory integration that affect her participation in daily occupations and limit her social opportunities.

An occupational therapy evaluation identified difficulties in the area of self-care, sensory processing, and social interactions. Winnie's mother describes her as high strung and says that she can be snobbish. She has only one friend. Her mother states that Winnie grows extremely anxious when her routine is interrupted and she has difficulty recovering – she says she 'can't breathe' and her heart is so loud it hurts her ears. When overwhelmed, Winnie is diagnosed with encopresis and has occasional 'accidents', wetting her pants. Asthma has been ruled out. Mother and father are very concerned about Winnie's behavior (avoidance, tantrums) and lack of interest in activities outside the house. She is overly avoidant of novel experiences. She has poor frustration tolerance and will become anxious to the point that she will cry or tantrum. As a child she refused to nap, and even now, transitioning to sleep can result in tears and tantrums.

17

## Function – dysfunction

Y	N	
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Optimal state of arousal
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Adaptive response to sensation
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Multiple sensory systems working together
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Adaptive response at child's current developmental level
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Able to tolerate frustration when given age appropriate tasks
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Adaptive sensory modulation, age appropriate end product skills
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Child self-directed
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Participates in sensory activities
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Age appropriate development
<input type="checkbox"/>	<input checked="" type="checkbox"/>	Tolerates increasingly complex challenges

18

continued

## Thinking about Interoception

Interoception is the sense that helps you understand your 'internal state', what's going on inside your body.

Interoceptive system is the sensory system of the internal organs (e.g., heart rate, hunger, digestion, state of arousal, mood, etc.). That's where the receptors are

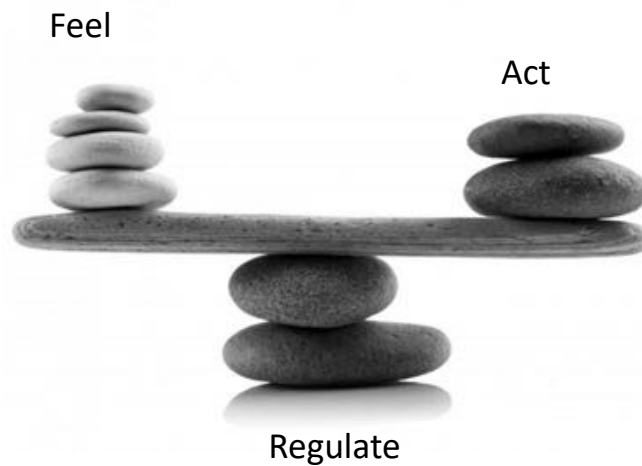
When there is dysfunction in this system, a person has trouble knowing when they feel hungry, full, hot, cold, have a full bowel/bladder or thirsty.

Thirst  
Heart beat  
hunger  
breathlessness  
Fullness (bladder)  
Fullness (bowel)  
**TEMPERATURE**

19

continued

## Goal: Homeostasis



20

continued

continued

## Emotional awareness...



21

continued

## Activities to build an emotional Vocabulary

- Label your own emotions
- Label your child's emotions  
(tie these to the body's sensations)
- Put emotions on a continuum



Building Our Emotional Vocabulary in Grade 2.1

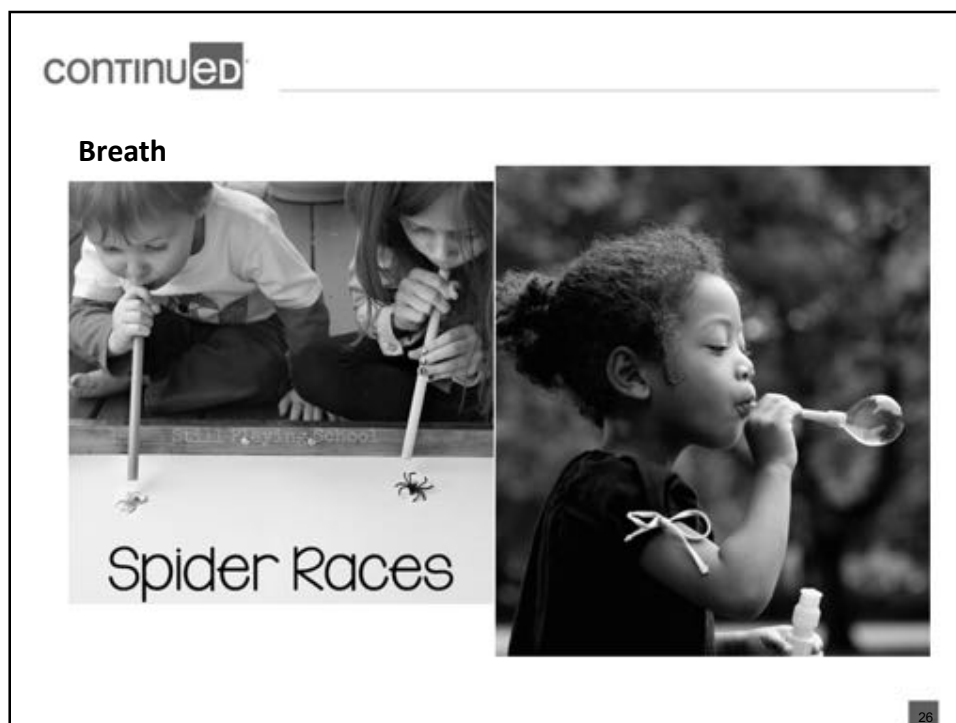
Sad	Mad	Glad	Bad
Unhappy	Angr	Joyful	Upset
Lonely	Frustrated	Happy	Guilty
Hurt	Tense	Calm	Resentful
Angry	Nervous	Content	Lonely
Confused	Jealous	Confident	Upset
Disappointed	Furious	Excited	Excluded
Deceased	Grumpy	Loving	Regret
Ignored	Amused	Amused	Sorry
	Cross	Relieved	Remorseful

22

continued

[illegible]

continued	
When I feel....	My body...
Angry	My cheeks get hot, I grit my teeth, my stomach hurts...
Lonely	My shoulders roll forward, my head tips forward, my breathing is long and slow
Emotional awareness   ←————→   Lack of awareness of body signs	
Body Scans: Check your body!	



## Sensory strategies to help with sleep/ Interoceptive system

1. Use the dark to create sleep/wake rhythms
2. Make bedtime a routine (use external cues to compensate for the lack of internal cues)
3. Overt relaxation to compensate for lack of internal capacity (Rainbow relaxation).
4. Use sensory strategies (proprioception/deep tactile)
5. Reduce anxiety (monster spray, routine, etc.)

27



**SLEEP IS AN ESSENTIAL PART OF YOUR DAY** to ensure we are healthy and ready to engage in what life has to offer. Going to sleep and getting enough sleep are important skills for children to learn. Optimal sleep helps to ensure that children are able to play and ready to participate in daily activities at school or at home, and it promotes growth and development. Parents often struggle with bedtime routines and making sure children go to bed at a reasonable time. A bedtime routine can help both parents and children make the daily activity of going to sleep a pleasant experience.

Sleep is one of the many daily occupations (activities) that occupational therapy practitioners help to promote. The following tips are from pediatric occupational therapy practitioners who have experience with educating parents on promoting healthy daily routines, including bedtime.

### If you want to:

Establish a specific bedtime and a bedtime routine.

### Consider these activity tips:

Select a bedtime that you feel is appropriate for your child based on his or her age and schedule, and be consistent, even on weekends and during vacations. If you have multiple children, you may want to identify different bedtimes to ensure you can help each one.

Establish a predictable, regular sequence of events to prepare for sleep and relaxation. Begin this bedtime routine about a half hour before.

If your child is able to talk, share reminders about when bedtime is coming, making something like, "First we put down their pajamas, followed by taking a bath and putting on our pajamas. Then we read a story and get into bed to go to sleep."

To ensure the bedtime routine, encourage your child to be part of the process. Ask what sleep clothes they offer choices of books, songs, etc., and suggest he or she get a favorite doll or stuffed animal to bed. Use a transitional item, such as a blanket or a soft toy.

## AOTA Fact Sheet

### Occupational Therapy's Role in Sleep

Bedtime and adequate sleep provides the foundation for optimal occupational performance, participation, and engagement in daily life, a concept that is theoretically connected with the development of occupational therapy. The impact of sleep on function and participation is recognized in the research of occupational therapy practitioners and addressed across the American Occupational Therapy Association (AOTA) framework and standards of practice for practice, research, and professional development.



Sleep insufficiency, defined as not obtaining restorative sleep, is a public health problem of concern for the American Occupational Therapy Association (AOTA). Sleep is linked to mental health, physical health, and overall health and well-being. Sleep insufficiency is also linked to chronic disease such as hypertension, diabetes, depression, and obesity, along with lower safety, quality of life, and productivity (CDC, 2015).

### Role of Occupational Therapy

Occupational therapists use knowledge of sleep physiology, sleep disorders, and evidence-based sleep promotion practices to evaluate and address the manifestations of sleep insufficiency or sleep disorders on occupational performance and participation. Sleep problems are addressed with children and families from the perspective of health assessment and health promotion. The following are examples of how occupational therapy practitioners may address sleep dysfunction among different populations and settings.

### Children With Autism Spectrum Disorder

Occupational therapy practitioners working with families of children with an autism spectrum disorder or another developmental disorder explore the impact of sleep deprivation on the child's and caregiver's ability to function effectively during the day. They address sensory-motor and behavioral challenges in bedtime routines, habits, and patterns. Cognitive-behavioral therapy interventions, or strategies to address sensory arousal or sensory seeking behaviors (e.g., a parent power-declining bedtime routine, making a consistent plan for sleeping through the night, focus on light exposure, light therapy or weighted blanket use, etc.). Managing the physical environment and enhancing observation skills help parents anticipate sensitive to change in clothing, toys, or family schedules. Calming activities and routines that do not hinder the family and can be consistently carried out sleep bedtime sleep.

### Older Adults in Long-Term Care

Practitioners working in long-term care settings for older adults develop individualized sleep routines, adjust the lighting to sleep devices and night, reduce staff noise, train staff to use recommended equipment for bed positioning, maintain hearing aids, and address other age-related, and address the client's needs for privacy, bedtime activity programs, including

[https://www.aota.org/~media/Corporate/Files/AboutOT/Professional s/WhatsOT/HW/Facts/Sleep-fact-sheet.pdf](https://www.aota.org/~media/Corporate/Files/AboutOT/Professional%20WhatIsOT/HW/Facts/Sleep-fact-sheet.pdf)

28



continued

All learning occurs



through the **senses**

29

continued

All learning occurs through the  
**senses**

Input ==> Learning ==> application  
\*\*\*

Sensory in ==> motor out  
\*\*\*

Faulty input in (distortion in sensory input )  
==>  
\*\*\*

faulty motor out (demonstration of learning / work product)  
\*\*\*

30

continued

continued

## Remember: Types of sensory patterns (profiles)

- Atypical sensory processing in interoceptive system
  - **Over-responsivity** to your heart beat, thirst, temperature, bladder/bowel sensations
  - **Under-responsivity** to your heart beat, thirst, temperature, bladder/bowel sensations
  - **Poor modulation** such as being unable to respond to sensation (your heart beat, thirst, temperature, bladder/bowel sensations) with behaviors that are consistent with the intensity of the input.

31

continued

## Sensory modulation of Interoception

- Individual's ability to respond adaptively to sensation over a broad range of intensity and duration
- Supports optimal arousal, attention, and activity level to meet the demands of the environment

32

continued

## Sensory discrimination of interoception

- Individual's ability to interpret and differentiate between the spatial and temporal aspects of sensory information
  - Where is it?
  - What is it?
  - When did it occur?

33

## Postulates Regarding Change for Sensory Modulation

- Intervention must be directed towards facilitating an adaptive response.
- Opportunities for AR's in one sensory system will likely lead to AR's in other sensory systems.
- When sensory modulation is brought to an optimal level, problems in other areas can be better addressed.
- Understanding of the sensory modulation issues allows life activities and routines to be structured to support optimal arousal.
- Support of the child's engagement in play that modulates sensory input will help develop self-regulation.

34

## HOW?

### Start with what you know

- Proprioception and deep pressure are organizing
- Input to the cells but impact (organization) is at the neuro-physiological (brain to body) level
- Modulation aka homeostasis aka regulation aka resilience aka recovery aka 'bounce back-ability' aka adaptive coping

35

## Case

Mary is 6 years old, she has no diagnosis but she has yet to achieve independence with toileting, frequently wetting or soiling herself at school. She says she just 'doesn't realize' when she has to go. She also has difficulty falling asleep at night and will not nap at school. Mary is a quiet child, and often seems somewhat 'tuned out'.

Using a sensory approach, specifically the interoceptive system, discuss what might be happening?

So how do we treat bowel and bladder?  
Sleep dysregulation?

36

continued

Intervention must be directed towards facilitating an adaptive response

- Listening to your body
- 5 point breathing (Breath in/ out...)



37

continued

Opportunities for adaptive response in one sensory system will likely lead to AR's in other sensory systems



Proprioception  
Deep Pressure  
Vestibular  
Tactile  
Auditory  
Visual



38

continued

continued

When sensory modulation is brought to an optimal level, problems in other areas can be better addressed



39

continued

Understanding of the sensory modulation issues allows life activities and routines to be structured to support optimal arousal



40

continued

continued

Support of the child's engagement in play that modulates sensory input will help develop self-regulation



41

continued



Because at the end of the day, development is in fact, child's play.

It's important to develop organizing routines and positive habits.



42

continued



continued

## References:

- Ayres, A.J (1994) *Sensory Integration and the Child*, 11th printing. Western Psychological Services. LA Calif.
- Kramer, P. & Hinojosa, J. (2010). *Frames of reference for pediatric occupational therapy*. 3<sup>rd</sup> ed.. Philadelphia, PA: Lippincott, Williams & Wilkins.
- May-Benson, T. A., & Koomar, J. A. (2010). Systematic review of the research evidence examining the effectiveness of interventions using a sensory integrative approach for children. *American Journal of Occupational Therapy*, 64, 403–414. doi: 10.5014/ajot.2010.09071
- Mahler, K. (2017). *Interoception: The Eighth Sensory System*. AAPC Publishing, Lenexa KS
- Parham, L. D., Roley, S. S., May-Benson, T. A., Koomar, J., Brett-Green, B., Burke, J. P., et al. (2011). Development of a fidelity measure for research on the effectiveness of the Ayres Sensory integration intervention. *American Journal of Occupational Therapy*, 65, 133–142. doi: 10.5014/ajot.2011.000745
- Schaaf, R.C. (2011). Interventions that Address Sensory Dysfunction for Individual's with Autism Spectrum Disorders: Preliminary Evidence for the Superiority of Sensory Integration Compared to Other Sensory Approaches. In Volkmar, F., Cicchetti, D., Reichow, P. Doehring (Eds). *Evidence Based Practices in Autism Spectrum Disorders*. Springer.
- Whitney, R. & Gibbs, V. (2013). *Raising Kids with Sensory Processing Disorders*. Prufrock
- Whitney, R. & Pickren, W. (2014). *Self-Regulation: A family systems approach*. PESI
- Whitney, R., (2018). *Sensory Integration & Sensory Processing Frames of Reference*. In *Clinical Reasoning in Occupational Therapy*, Cronin & Graee, Eds. AOTA Press

continued



continued

---

Questions?

[whitneyrondalyn@gmail.com](mailto:whitneyrondalyn@gmail.com)

45

continued