Application

Evaluation and Accommodations
Objectives: Series III

From a dynamical systems’ framework participants will:

- Gain knowledge in activities that can promote the development of efficient postural control and attentional systems.

- Gain working knowledge in how the environment can impact performance in the school setting and clinics; and the environmental supports that can be used to reduce the need for attentional resources in busy environments.

- Gain working knowledge in the analysis of tasks according to their attentional requirements based on the research in the areas of attention and postural control and their interaction.
Dynamical Systems

- Developing Systems
- Environment
- Behavior
- Task
Dynamical Systems: Non-linear Property

- A small change in the maturation of a system, in the environment or task can affect larger changes in the behavior of the child.
Dynamical Systems Framework

- Systems: Attention and Postural Control
  - Activities that promote efficient development of attention and postural control.
  - Evaluating deficits in attention and postural control.
- Interaction with the Environment
  - Evaluation
  - Accommodations
- Demands or Constraints of the Task
  - Task analysis
  - Accommodations
Systems
Posture in Stance

- Postural Stability: Increases with age or experience.
- Before age of 4 years, primary sensory input to control sway is vision.
- 4-6 years: Transition period marked by variability in sensory strategy to control postural sway.
- 7-10: Much less postural sway and beginning to use somatosensation as the primary sensory input to control postural sway.

Attention

- Development of Alerting and Orienting function within 12 months of age.
- Executive Attention:
  - 18-24 months marks an important interval in capacity to focus.
  - 5-10 years an important interval in the ability to inhibit irrelevant stimuli or resolve conflict between 2 stimuli.
  - 6-8 years is the largest developmental interval.

From research by Reilly:
- 4-6 years: Less attentional resources compared to older children 7-12 years.
Children with Cerebral Palsy

Posture in Stance
- Instability due to deficits in:
  - Posture Alignment
  - Postural muscle tone
  - Muscle response to sway in force and timing.
  - Adaptation to changing sensory environments.
  - Compromised breathing

Attention
- Reduced attentional capacity resulting from a brain lesion.
  - Cortical Lesions as in Spastic CP
    - Reduction in the ability to inhibit distractions
    - Reduction in the capacity to resolve conflict for processing between two stimuli (divided attention)
  - Cerebellar lesions as in Ataxic CP
    - Reduction in the capacity to shift attention between two stimuli for processing.
Posture Control

Promoting Development of Postural Control
Pyramid of Motor Skill Development

- Early Sensory-Motor Experiences
  - Pre and Post-natally
- Body Schema
- Postural Control
- Perceptual-Motor
- Skill
Application: Building Body Schema for Postural Control

- **Infants (Early Body Schema Development)**
- **Resource:** *Building Babies Better* by Roxanne Small, PT

- Early Tummy Time and skin to skin contact
  - Slick surface: Reduce friction of movement
  - Low lighting for orienting attention to tactile and proprioception ‘matching’ on slick surface.

- Limit time in movement- constricted environments, i.e., car seats, swings, walkers.

- Attention directed towards body-movement senses. Limit ‘busy’ visual environments and visually stimulating toys.
Application: Continued Development of Body Schema

- **Toddler - School Age**: Perceptual Motor activities, i.e., obstacle courses
- Rolling, crawling (through, up, down, inside, on top of, etc.) climbing, pulling, pushing provides:
  - Opportunities for challenging the various functions of postural control (stability and support for mobility).
  - Opportunities for learning sensory strategies for postural control in changing environments and according to the demands of the task.
Attention

Promoting Development of Attention
“If you look at what predicts how well children will do later in school, more and more evidence is showing that executive function of attention, working memory, and inhibition actually predict success better than an IQ.” Adele Diamond, PhD
Resources

- http://www.changingbrains.com
  - Review of the attentional system
  - Download computer programs for increasing skills in the 3 networks of attention
- Attention in Early Development by Ruff and Rothbart
Infants to Toddlers

- **Infants:**
  - Alert: Activities that calm baby, avoiding stimulation that causes over-arousal.
  - Face-to-face contact when alert

- **3 mos- 1 year**
  - Joint attention: Directing attention.
  - Providing opportunities for sensory-motor exploration (affects selective attention).

- **1yr.-Toddlers:**
  - Structured routines at home and daycare
  - Provide social experiences
  - Teaching social standards through example or through verbal communication.
  - Continued joint attention through language
Preschool and School-Age

- **Mind in the Making** by Ellen Galinsky
- **Focus:** Puzzles, “I spy”, Musical Chairs, Listening to stories.
- **Inhibitory:** Simon Says, delay gratification
- **Short term memory:** Remembering rules to a game, Concentration, Motor sequence.
- **Cognitive Flexibility:** Changing the rules, i.e., sorting by shapes vs. color;
Technology Use and Attention

- From *The Brain that Changes Itself* (Doidge)
  - Research: 26 toddlers: Early exposure to TV between 1 and 3 yrs. correlates with problems paying attention and controlling impulses later in childhood.

- From research by D.R. Anderson, PhD
  - Research: Children under 2 years of age learn more from real life experiences than TV educational programs compared to older children

- Research: TV as background noise:
  - Reduces focus
  - Reduced play time with one toy. Tended to move from toy to toy
  - Play episodes were shortened
Interaction of Posture Control and Attention

Dual Task Condition
Developmental Trends in Dual Task Condition (Posture Control and Cognition)

- Even a fairly easy postural control task like wide stance required attentional resources in young children (4-6 years).

- All children prioritized the performance of the cognitive task over the postural control task in the dual task condition.

- The young children (4-6 years) experienced an even greater interference in postural control when controlling a more attentionally demanding posture.
Children with CP and Dual Task (Posture Control and Cognition) Condition

- Posture interference in both easy and difficult postures
- Greater interference in the more difficult posture (narrow stance)
- Children with the most instability (Ataxia CP), had the greatest interference in both the control of posture and cognitive task.
Assessment

So…..Why Aren’t They Paying Attention?
Assessment: Postural Control

- Sensory: Vision, Somatosensory, Vestibular

- Sensory strategies: Adapt to changing environment (P_CTSI B)

- Musculoskeletal: Alignment, strength, ROM

- Neuro-muscular: Co activation, proximal-distal, delayed onset, poor scaling of force.

- Respiration: Attentionally demanding due to trunk muscle weakness.
Assessment: Executive Attention

- Behavioral State (Attentive): Reduced capacity to regulate their state of behavior.

- Inhibition: Lack ability to inhibit irrelevant stimuli or inhibit motor response.

- Decreased short term memory capacity.

- Cognitive Flexibility: Decreased ability to switch from one idea to another or operate under changing rules.

- Poor attention span and focus.

- Reduced capacity to resolve conflict between two stimuli competing for processing resources (divided attention).
Video I_trauumatic brain injury
Environment
Assessment of Environment

Consider all environments in child’s day.

- Individual one-on-one (attention externally directed).
- Small group vs. large group
- Classroom vs. hallways vs. playground or clinic vs. home vs. community.
- Support surfaces, i.e., linoleum vs. carpet vs. wood chips.
- Visual or auditory distractions
Environment Accommodations

- Reduce visual and auditory distractions
  - Less attention needed for inhibiting irrelevant visual stimuli
  - Less attention needed to inhibit an impulsive response.

  - Directs orientation response for quicker processing
  - Reduces the need to scan the entire room

- Auditory Strategy:
  - Microphone: Reduces need for inhibiting irrelevant auditory
  - Inflection in voice (increasing alertness with novelty)
  - Bell indicating transitions or further directions. Alerting

- Incorporate a ‘sensory corner’ in classroom design
  - Sensory ‘diets’ : Increasing or decreasing arousal
  - Self-regulation
Cover shelving to reduce visual distractions
Reduce background visual distractions
Visual Strategies: Who is in What group
Visual Strategies:
When
Task Analysis

Based on Posture and Attention Research
Automatic vs. Effort in Skill Development

“The more familiar and well practiced a task, the less attention the task requires. Because attention is of little supply, automatization is crucial to skill development.” Whyte, J

“For long term changes in the brain, close focus is required in performing a task. Even though you can learn when you divide your attention, divided attention does not lead to long term changes in the brain maps.” Merzenich, M
Task Characteristics

- Simple vs. Complex: How many sub-tasks are imbedded in the task?

- Each Sub-task:
  - Not present (learning)
  - Emerging
  - Automatic

  Greater attentional resources required
Task Components

Postural Control Component

- **Stability** (Maintain or regain balance)
- **Stability with Mobility** (preparation for movement and orienting body segments dependent upon the goal of the task).

Motor Skill:

- **Gross Motor**: Jumping, Galloping, skipping, equipment use
- **Fine Motor**: Grasp, tracing, coloring, copying, forming letters
- **Speech**: Articulation and sound production (breath control).
- **Oculomotor**: Movement of both eyes for reading.
Task Components

Cognitive Task (Easy vs. Difficult)
- Language
- Perceptual Analysis
- Comprehension
- Planning
- Short or Long term memory: Quantity

Attentional Requirement of any of the subtasks
- Not Present (Learning)
- Emerging:
- Automatic: Easy stimuli-response

Increase Processing Time
Task Analysis Form_template
Accommodations: Task

Based on Research: Interaction of Attention and Posture Control
Educational Setting: Focus on Academics not Posture

- Reduce attention to posture
  - Appropriate size desk and chairs. Desk ~ 1.5” above elbow height.
  - Ball chair or wedge (caution: may increase attention to posture).
- Alter positions during a long teaching session, i.e., sitting to prone.
- Adapted positioning for those with postural control deficits.
Video 2_Alternate Positions
Video 3_Optimal Seating
Clinical Setting: Focus on Postural Control

- **Reduce attention to cognition**
  - **Simplify** instructions (reduce attention to perceptual analysis of language comprehension)
  - **Repetition** of activities, games to reduce motor planning.

- **Dual Task Training**
  - Silsupadol, Patima (2009): Training of BIOA in dual task condition. Found that
    - Varying the attention between balance and cognitive task improved single task balance and balance in dual task condition.
    - Improved **cognitive** performance in single task and dual task performance.

- **Progress from small to large group setting**
Task: Obstacle Course on Scooterboards
Task Components

- Postural Control
  - Stability on scooterboard
    - Orientation of body on scooterboard
    - Mobility of arms (preparation)
- Motor Skill:
  - Eye-hand coordination
  - Bilateral coordination of arms
- Perception and Action:
  - Around cones
  - Between Cones and under bars
  - Weaving between cones
- Cognitive Task: Short Term memory
Task Analysis Form Example
Pre-School

- 3 year old:

- 4 year old
Purpose:

1. Reduces attention to posture stability on a scooter board
2. Integrates tactile and proprioception
3. Direct attention to body awareness of specific movements
Video 5: Orientation on Scooterboard
1. Around the cone and back

2. Between the cones
Colored bars over the cones provide visual guides for weaving in and out of the cones.
Once the pattern of movement is automatic, can remove the visual guides and increase the perceptual task (weaving between the cones).
Video 6: Task Analysis Cones
Classroom Global Workspace

Designing classroom environment based on attentional requirements of the tasks
Teacher Directed: Learning

Snack

Manipulatives: Math and Fine Motor

Practice: Previous Learned Concept

Teacher Directed: Learning

Attention

Reading corner; Books, puzzles, games

Less attention

Less attention
Fine Motor: Dynamical Systems Approach

- Researchers
  - Thelen, E
  - von Hofsten, C

- Individual systems
  - Postural Control
  - Fine Motor Development
    - Early Sensory Motor Patterns
      - Hand to mouth: Intrauterine pattern
      - Control in reaching prior to precision grasp
      - Bilateral before unilateral control
    - Body Schema for:
      - Reaching
      - Grasping

- Task Analysis
- Environmental conditions

Perceptual-motor

Motor skill
Discussion