



Neurodevelopmental Model of Evaluation and Service

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Outline of Presentation



- **Introduction:**
 - Rationale for the development of the Neurodevelopmental model:
 - Special Education context
 - Pediatric Neuropsychology context
 - World Health model context
 - Translational neuroscience and neuropsychology context
- **Overview of the Neurodevelopmental Model**
 - Structure
 - Evaluation and Service Method
- **Case Studies**

The Neurodevelopmental Model of Evaluation and Service



The Neurodevelopmental Model of Evaluation and Service is a framework for the practice of single-case study and treatment in the schools.

It requires the translation of neuropsychological information to enhance sensitivity and specificity of the determination of disability, and to drive intervention that demonstrates positive outcomes in quality of life.



Sensitivity & Specificity

	Disability Present	Disability Absent
Test Positive	True Positives	False Positives
Test Negative	False Negatives	True Negatives

Sensitivity is the proportion of students **with** disability who test **positive**

Specificity is the proportion of students **without** disability who test **negative**

Special Education Context

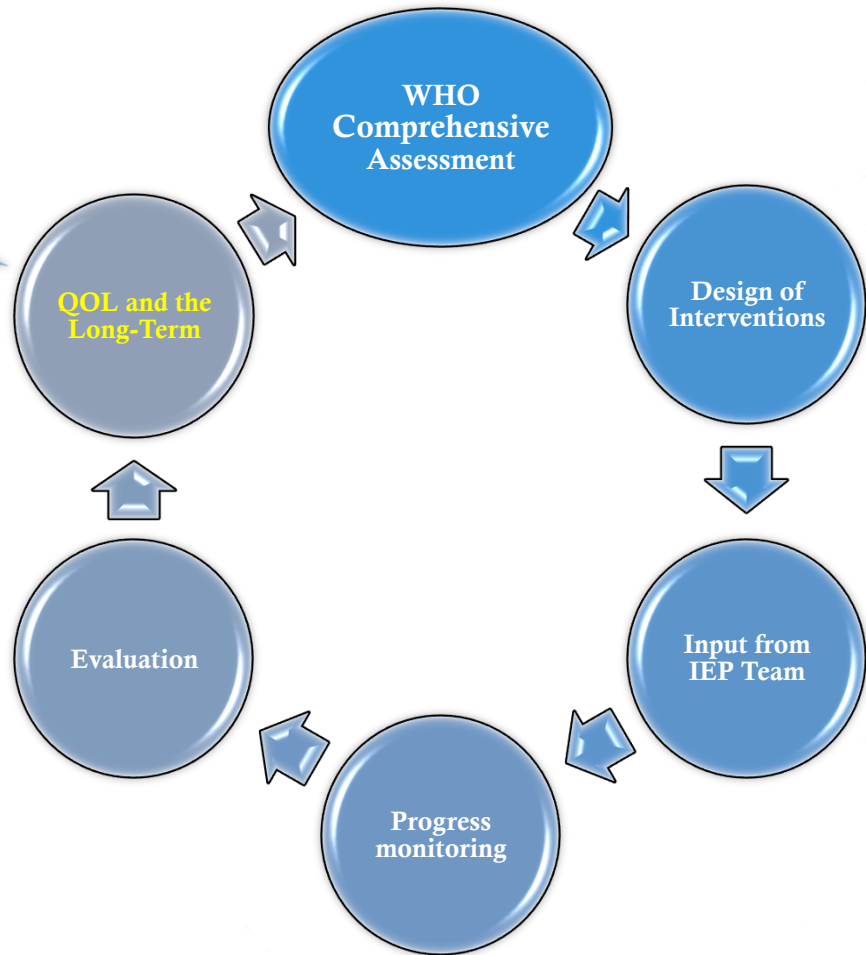
- Increase in medically complex cases due to shorter hospital stays, medical advances in TBI, cancer and other chronic illnesses; increases in survival rates of premature and low-birth weight children
- Adoption of cognitive strengths & weaknesses model of learning disability determination reflecting Federal Law and “neurodevelopmental” origin of SLD
- Change to levels of support...



World Health Organization Comprehensive Evaluation of Disability

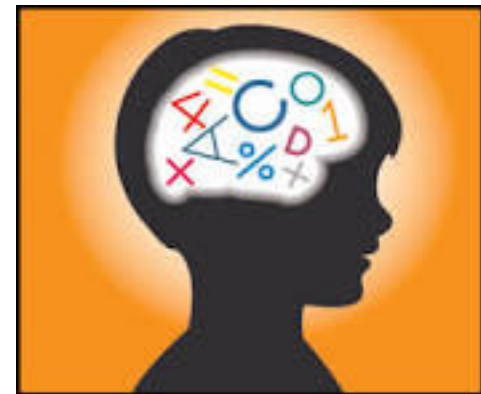
Very Important
Shift (ICF)

The value of comprehensive child psychological and neuropsychological evaluations and interventions will be determined by analyses of level of support needed and quality-of-life evaluations...



Pediatric Neuropsychology Context

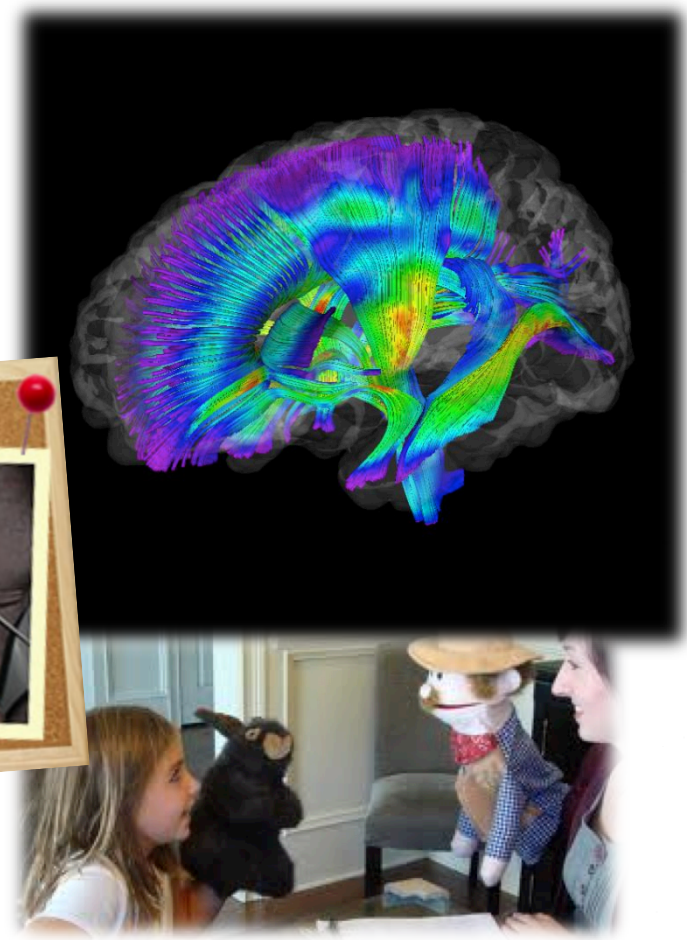
- Increase in Independent Educational Evaluations
- Partnerships with school personnel to implement recommendations
- Continuity of care across settings
- Expert testimony in hearings
- Translation of neuroscience into practice



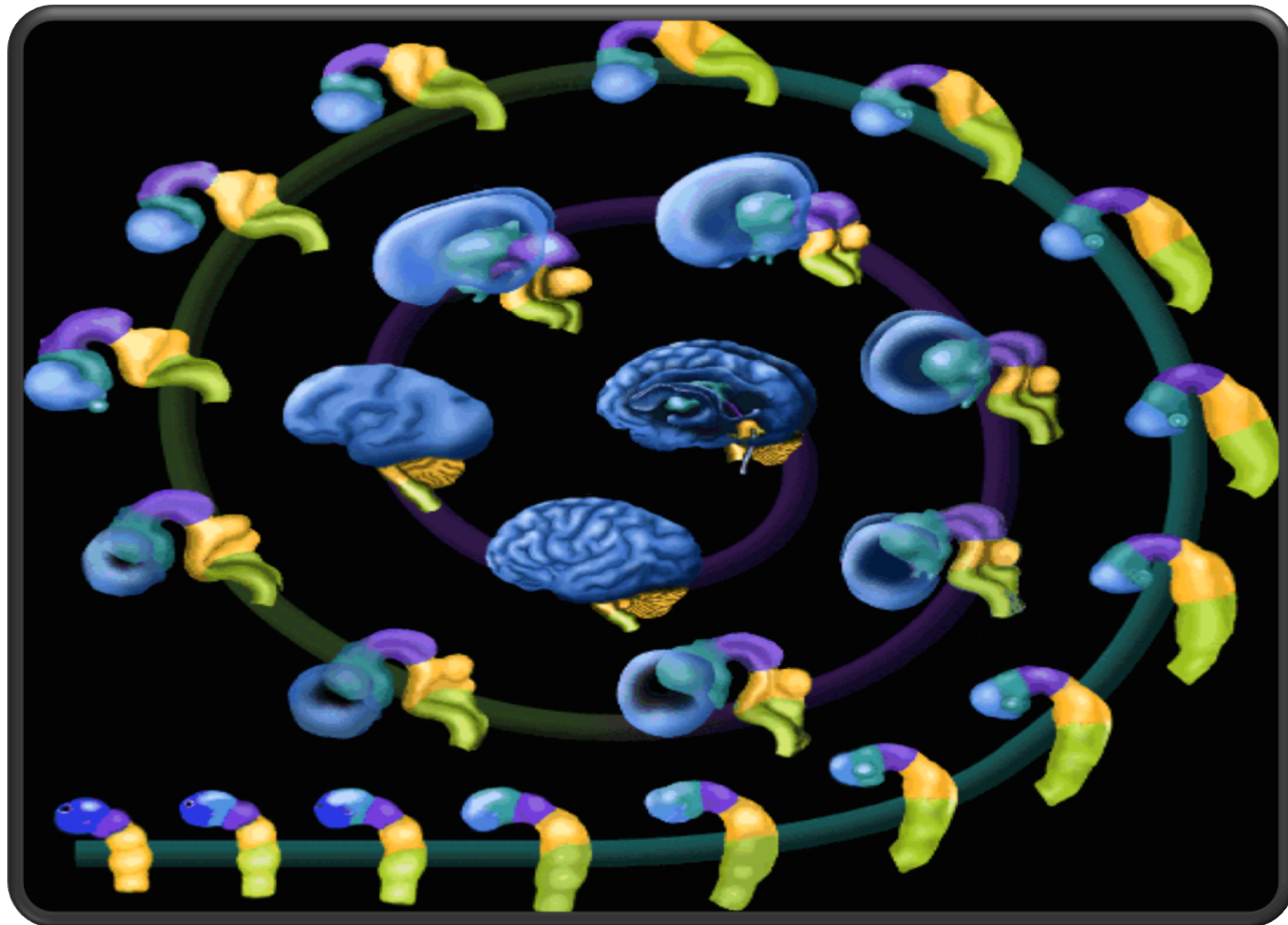
Translational Neuropsychology: From Plasticity to Intervention

Growing body of research...

- Sally & Bennett Shaywitz
- George McCloskey
- Michael Boivin
- Michael Posner
- Bruce Perry
- Jack Naglieri
- Brad Hale
- Cecil Reynolds
- Margaret Semrud –Clikeman
- Dan Seligman



Overview of Model



Neurodevelopmental Model



Fundamental Assumptions for the Comprehensive Evaluation

- Based on current knowledge in neuropsychology
- Culturally competent
- Developmentally appropriate
- Environmentally/setting appropriate
- Individualized interventions
- Generalizable across settings
- Basis for outcomes assessment



Structure of the Comprehensive Evaluation

- History: Cultural, familial, medical and academic contexts
- Assessment of:
 - Sensory, arousal, tempo and perceptual (Block 1)
 - Integrative integrity of information processes (Block 2)
 - Executive control and output (Block 3)
- Design and implementation of intervention
- Design and implementation of outcome evaluation
- Evaluation of Quality of Life

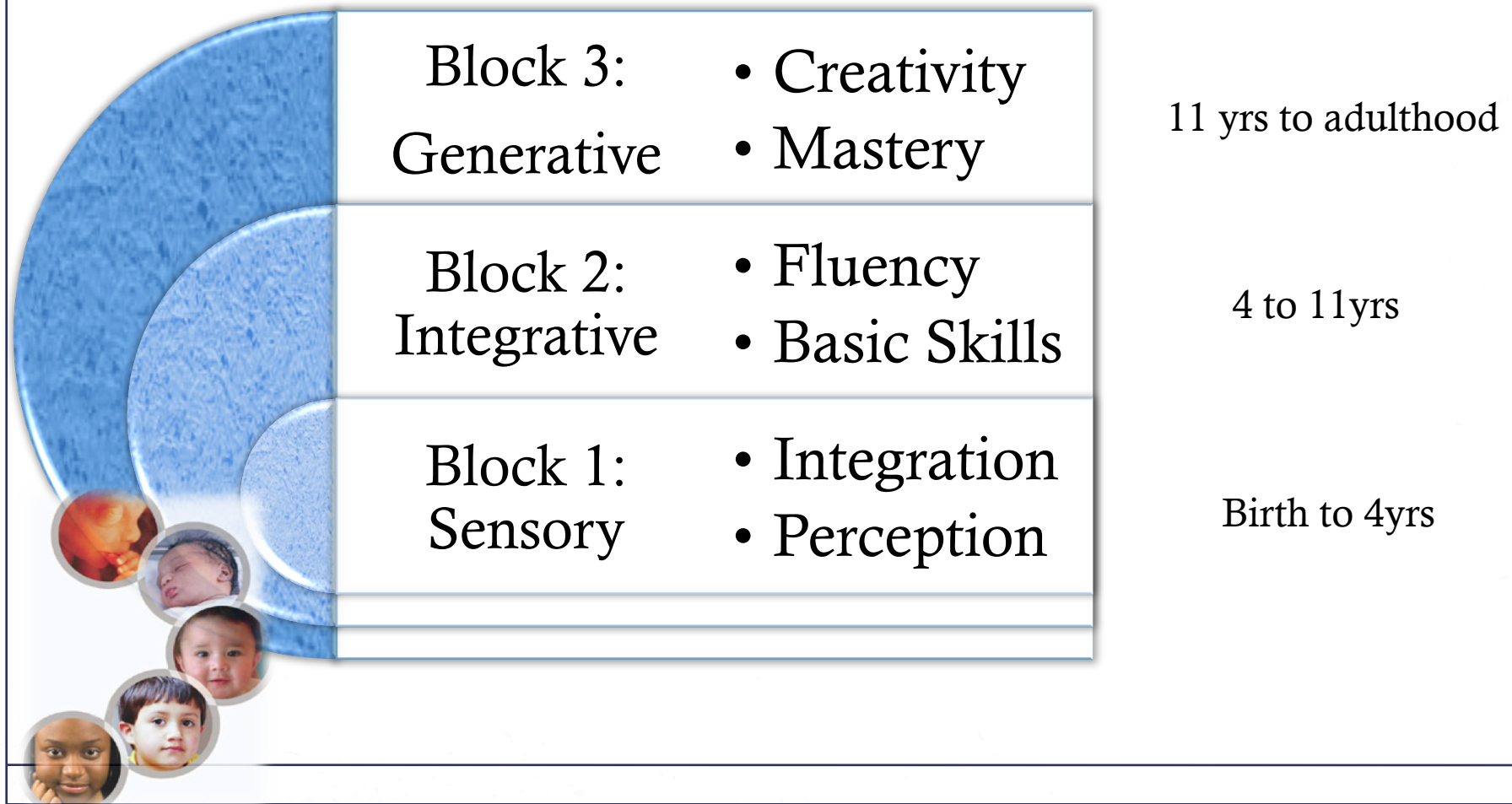


Alexander Luria

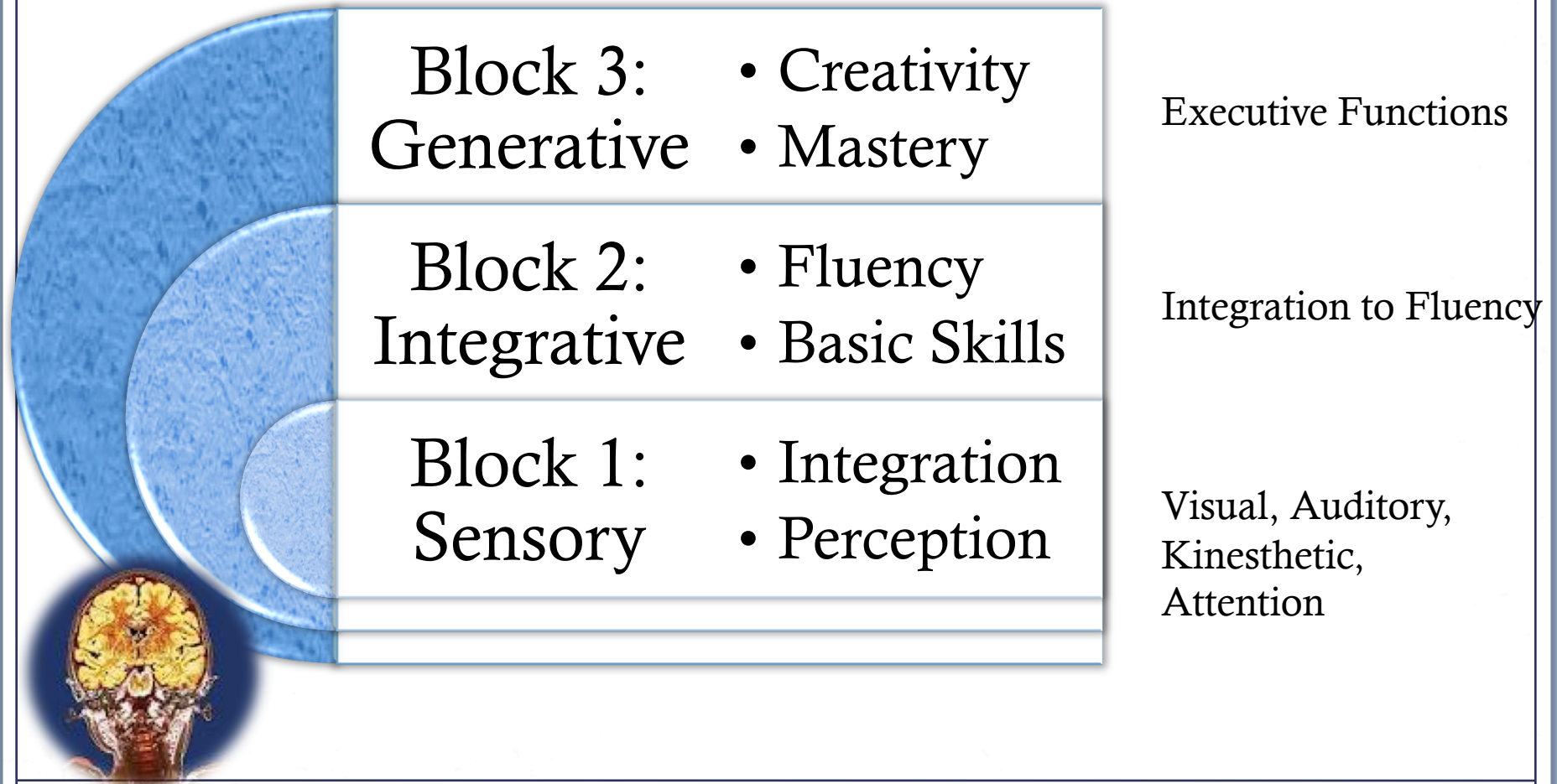


L.S.
Vygotsky

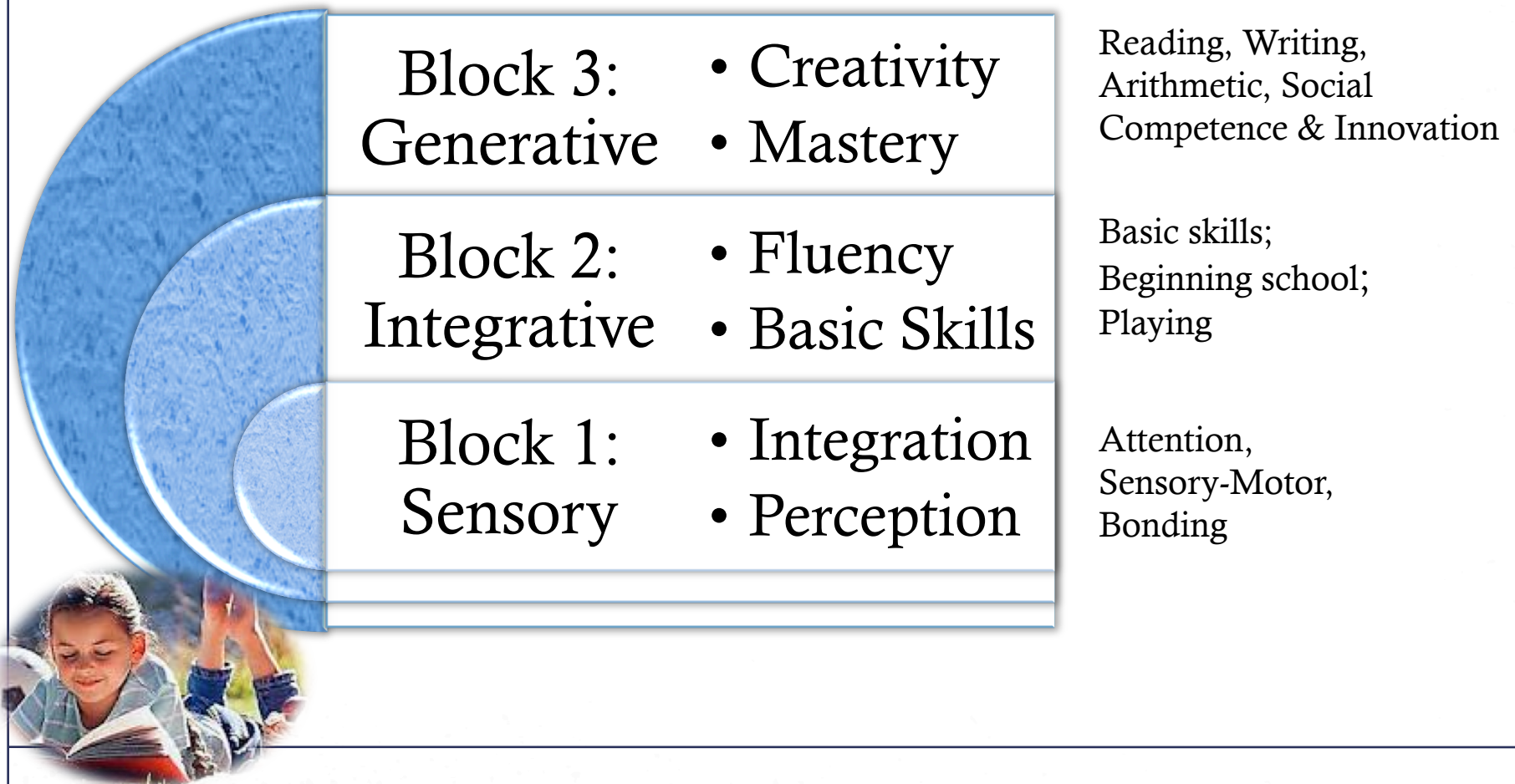
The Comprehensive Neurodevelopmental Evaluation



The Comprehensive **Neuro**developmental Evaluation



The Comprehensive **Functional** Neurodevelopmental Evaluation



Areas of Evaluation

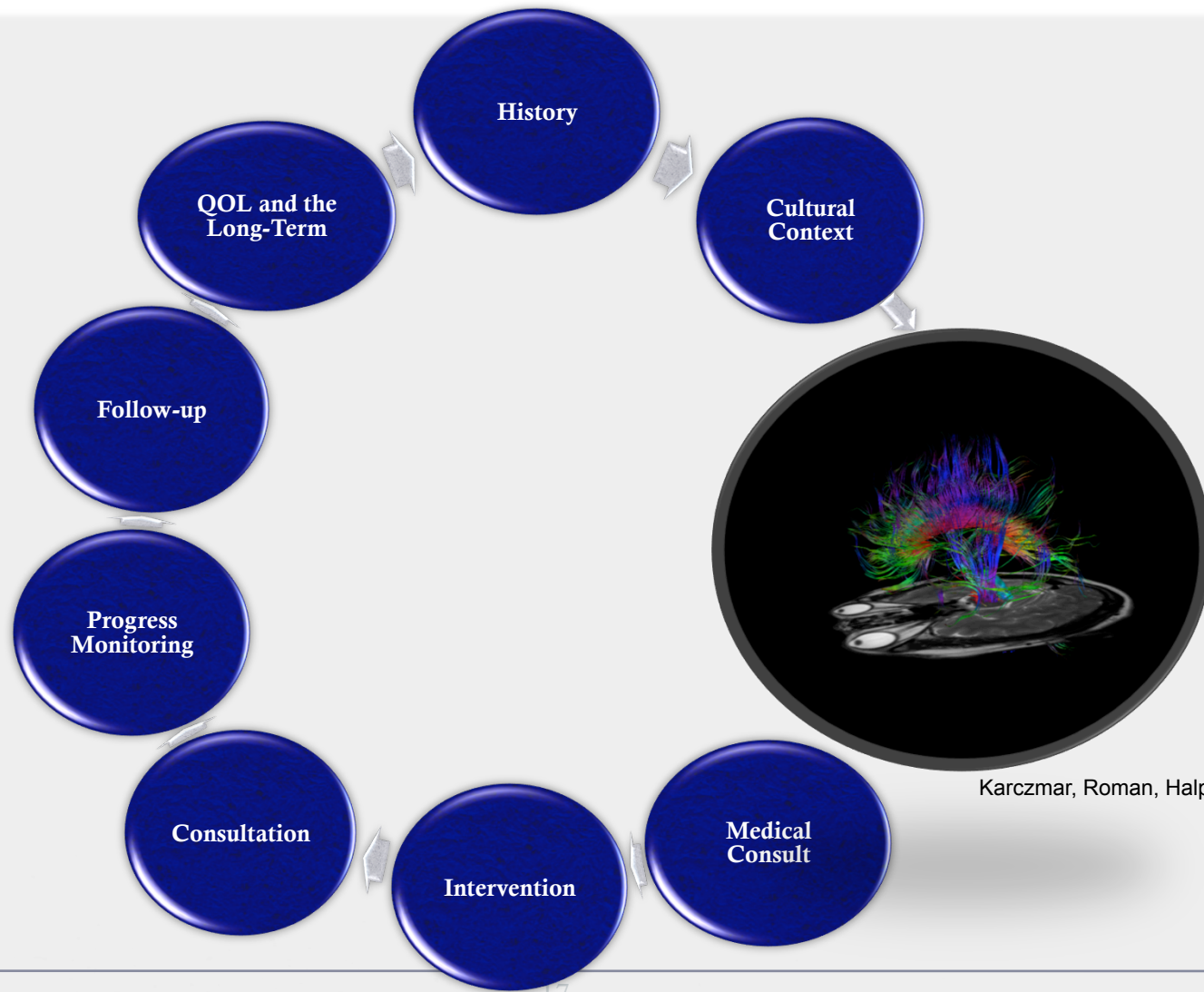
Cognitive processes

- Auditory processes
- Visual processes
- Motor/kinesthetic processes
- Language
- Attention/Executive Functions
- Memory
- Social/emotional

Cognitive product

- Reading
- Math
- Written Expression
- Social relationships

Neurodevelopmental Method



Karczmar, Roman, Halpern, Pan, 2012

Neurodevelopmental Model of Assessment & Intervention
Elaine Fletcher-Janzen

Cognitive Processes

Cognitive Product

	Auditory	Visual	Sensory Motor	Language	Executive Attention	Memory	Social emotional	Reading	Math	Writing
Block 3 Generative	Listening comprehension -inferential	Visual problem-solving	Smooth, complex fine and gross motor	Oral expression of abstract reasoning	Insight; Complex problem-solving; Planning; Meta-cognition; Efficiency	Long-term storage & retrieval; Association	Tolerance of ambiguity; Conflict resolution; Humor; Social skills	Reading Comp Inferential; Reading Comp concrete	Math problem-solving; Math formulae	Written express (creative); Written express (concrete) Factual writing
Block 2 Integrative	Listening comprehension -concrete; Auditory perceptual skills	Visual or spatial integration; Visual perception skills	Visual-motor integration; handwriting fluency; Motor planning; Left/Right	Verbal and nonverbal communication; Prosody	Goal selection; Motivation; Basic self-regulation; Sustained attention; Inner speech; Pretend play	Categorical fluency; Semantic fluency; Memory strategies; Working memory-executive	Theory of Mind; Emotional regulation; Perspective-taking	Fluency with prosody; Fluency-word calling Word attack & decoding	Math facts Fluency; Math facts Math operation	Spelling fluency; Grammar fluency; Spelling vocab
Block 1 Sensory	Auditory perception discrimination; Phonological loop	Visual perception discrimination; Visual sketch-pad	Tactile; Proprioception Oral-motor	Articulation Receptive understanding; Nonverbal gestures; Pragmatic need	Inhibition Attention Salience Orienting Alerting	Prototypic memory; Procedural memory; Phonological loop; Visual sketch-pad STM	Prosody; Affect identification self & others; Face recognition;	Phonological awareness; Alphabetic principle; Orthographic knowledge: Literacy exposure	Number & fact recognition; Number sense; Literacy exposure	Spelling basic words; Basic grammar; Hand-writing

	Auditory Processes	Methods of Assessment Examples	Methods of Intervention
Block 3 Generative	Listening comprehension inferential Follow complex directions without visual cues	Listening comprehension subtests (inferential items) Ceiling items on remembering directions subtests Riddles Observation e.g. excessive or circular responses, long pauses before answering, stalling	Top down Elaborating and improvising use of visual compensatory strategies; note-taking; social skills
Block 2 Integrative	Listening comprehension concrete; Auditory associative memory Auditory processing of phrases & sentences Auditory inflection & intonation & prosody Auditory-phonological loop Auditory working memory	Listening comprehension subtest (concrete items) Memory for stories, immediate and delayed Phonological working memory subtests Subtests for remembering directions Memory for names Observation e.g. incongruous or off-topic answers; struggles to follow conversation with background noise	Bottom up fluent visual cue use; explicit instruction of visual cue use; advanced prep paraphrasing; pre-teach rehearsal; chunking
Block 1 Sensory	Auditory processing of information and making it salient to task Auditory STM Auditory discrimination-detect difference between speech sounds and sequencing Auditory perception—identify, interpret, and attach sound to meaning Sound localization Sound lateralization Auditory pattern recognition Interpreting competing acoustic signals Pure tone reception	Following simple directives without visual cues Auditory short-term memory tests (e.g. Digit Span) Phonological Awareness measures Dichotic listening Audiological exam School Hearing Screening (including hyperacusis) Observation e.g. head tilt/orientation, request for repetition, nonresponsive; History review with family (e.g. ear infections; ototoxic medications; tubes)	Depends on age and severity of deficit SLP therapy; slow rate of speech; visual cues; shorten oral directions; quiet environment

	Visual Processes	Methods of Assessment	Methods of Intervention
Block 3 Generative	Innovative visual design Visual problem-solving Visual long-term storage & retrieval	Creativity measures Block design ceiling items Ravens Progressive Matrices Route finding Observation e.g. generation of alternate visual ways of representing ideas	Top down Oral rehearsal of procedures; talking through; spontaneous use of tracking tools; support spontaneous compensatory strategies
Block 2 Integrative	Visual-spatial integration Identification of letters, numbers, symbols Design fluency Visual perception skills	Design fluency Block Design, Ravens basic items Rey-Osterrieth & delayed Visual memory subtests Observation e.g. lack of careful analysis of visual stimuli; inconsistent spelling	Bottom up E-notes; overlearning; enhance compensatory strategies; auditory/oral supports
Block 1 Sensory	Visual working memory-sketch pad Visual STM Directionality Spatial memory Spatial awareness Color perception Visual perception: recognition, discrimination; closure Visual efficiency: near point, saccades, pursuits Visual acuity: near & far	Motor-free visual perception test Visual digit span Arrows Spatial memory subtests Matching of designs Color blindness test Eye efficiency screening & Vision screening Hx with family Observation e.g. lack of navigation using visual cues	Depends on age and severity of deficit Books on tape; reduction of visual stimuli; kinesthetic cues; corrective lens

Motor Processes		Methods of Assessment	Methods of Intervention
Block 3 Generative	Smooth complex fine motor Smooth complex gross motor	Handwriting Hand Movements Functional skills Arts & Sports Observation e.g. self-directed focused practice of problem areas	Top down Computer use; note-taking programs; self-development of compensatory actions
Block 2 Integrative	Motor fluency Handwriting fluency Visual-motor coordination Visual-motor integration Motor planning Left/Right	Motor sequencing: complex Rey-Osterrieth Bender Gestalt Beery Bruininks-Oseretsky Test Observation e.g. frustration with manipulatives; poor decoding but good phonological awareness	Bottom up PT Keyboarding; music therapy; spatial-video-games; wobble boards
Block 1 Sensory	Eye-hand coordination Proprioception Finger perception Tactile Grip Balance	Tactile recognition Imitating hand movements Manual motor sequences: simple Finger tapping Hx with family Observation e.g. clumsiness, poor grasp, hand discomfort, excessive pencil pressure	Depends on age and severity of deficit OT & PT services; pencil grips; large line paper; crafts, individual sports

	Language Processes	Methods of Assessment	Methods of Intervention
Block 3 Generative	Oral communication of ideas, thoughts, bases for opinions, oral debate; pathos Complex pragmatics Use of metaphor	Verbal expression subtests Absurdities/wit Analogies Ceiling items on Similarities Verbal fluency Observation e.g. verbosity; focused in oral debate; evidence of paraphasias or word finding difficulties when fatigued	Top down Formal reasoning-logic instruction; bibliotherapy; debate training; speech writing; story-telling
Block 2 Integrative	Basic pragmatics Prosody Sentence formation Oral presentation of ideas/sequencing Receptive directions complex Paraphrase directions Non verbal communication	Pragmatics subtests Grammar subtests Repeating/paraphrasing directions Observation e.g. awareness of discord between speech and nonverbal cues/body language; mutism; filler words; pragmatics are off;	Bottom up Bibliotherapy; subtle cueing; guided reading; social coaching SLP guidelines, word banks
Block 1 Sensory	Use of sign Receptive and expressive language: words/sentences Functional pragmatics (need): expressive Functional pragmatics (need): receptive Mimicking speech Babbling Articulation of speech sounds Orientation to speech sounds	Speech & language basic skills Articulation subtests Observation e.g. unintelligible speech; not following directions; hesitation; excessive copying of peers	Depends on age and severity of deficit SLP therapy; social sensitivity; Cueing (magic word?)

Attention/Executive Processes		Methods of Assessment	Methods of Intervention
Block 3 Generative	Insight Complex problem-solving Planning Strategizing Organizing Metacognition Cognitive flexibility Efficiency	Ceiling items on IQ tests Ravens Progressive Matrices Wisconsin card sort Category test Rey-Osterrieth Observation e.g. error monitoring; delegating; managing long-term project independently; sequential flow of ideas in work product; correctly predicting obstacles in advance; generating novel solutions	Top down Advanced organizers; assisted strategy formulation; critical analyses of plans
Block 2 Integrative	Goal selection Motivation Basic self-regulation Inhibition Inner speech Executive attention network Divided attention Sustained attention Perseveration Imaginative play	N-backs (2 and up) Continuous attention Color interference Trails A&B Bender Rorschach Observation e.g. ability to regroup after distraction; ability to shift task; transitions; frustration tolerance issues; pretend play	Bottom up Assist development of internal sources of motivation; self-regulation routines
Block 1 Sensory	Inhibition Salience Orienting attention network Alerting attention network Arousal/cognitive tempo	Continuous attention N-Backs 1 Mental status Hx with family Observation e.g. Lack of initiation in routine and novel situations; slow -moving; passive: startle response; hyper-arousal: Hypervigilance (pays attention to everything-too much anticipation)	Depends on age and severity of deficit Attention games; memory activities; stories; Mr. Rogers

Memory Processes		Methods of Assessment	Methods of Intervention
Block 3 Generative	Long-term storage & retrieval Automatic memory strategy generation	Information and crystalized knowledge subtests Reading comprehension, math problem-solving Observation: e.g. perplexity (lack of confidence in recall); excessive use of vague, “filler” words; spontaneous use of memory strategies; self-cuing; circumstantial stories	Top down Encouraging mnemonics, faded prompts of strategies; notebook and note-taking software
Block 2 Integrative	Episodic memory Semantic memory Narrative memory Working memory	Delayed memory subtests Color interference subtests Observation: e.g. poverty of recall of story themes or details; word finding difficulties; recognition memory is not substantially better than free recall; recurrent intrusion of inaccurate content; frequent “re-starts” or recognition of losing place/thoughts	Bottom up Graphic organizers; state dependent learning; enhancing context cues; errorless learning; chunking
Block 1 Sensory	Short term memory: auditory, visual & haptic	Digit span Visual digit span Hand movements Observation: e.g. confusion or failure to recognize previously learned material; lack of practice effect; no rehearsal strategies; use of ineffective strategies	Depends on age and severity of deficit Direct instruction of strategies e.g. rehearsal; visual cues; games

	Social/Emotional Processes	Methods of Assessment	Methods of Intervention
Block 3 Generative	Social skills Humor Conflict resolution skills Appreciation of ambiguity	Broad-based psychological measures Interview Behavioral history Observation: Comfort with alternative points of view without defensiveness or hostility; Appreciation of learning as a process rather than a product; Compassion to self and other; uses physical feature or habit to discriminate individuals	Top down Self advocacy skills; conflict negotiation; self-cueing, Encourage process rather than product focus; Curious attitude about mistakes, psychotherapy, bibliotherapy
Block 2 Integrative	Theory of mind Perspective-taking Affect regulation Affect expression Affect identification (self) cooperation	Theory of mind subtests Interview Feelings identification subtests Behavioral history Observation: e.g. expresses wants effectively; sought out by other children during play; articulates viewpoint of another; misses social cues; requires external coaching	Bottom up Coaching in actual setting; Affect ID instruction; Affect compensatory strategy instruction
Block 1 Sensory	Theory of mind: awareness Affect recognition: others Facial memory Face recognition	Theory of mind: basic items Affect recognition subtests Facial recognition/memory subtests Observation: e.g. poor eye contact, disinterest in others; fails to look where another is looking or pointing; sticky attention; little imitation	Depends on age and severity of deficit SLP driven; reinforcement for initiated contact

	Reading Processes	Methods of Assessment	Methods of Intervention
Block 3 Generative	Reading comprehension critical analyses Reading comprehension: inferential Reading comprehension: concrete/literal	Reading comprehension achievement subtests Observation e.g. reads well with prosody but does not comprehend beyond a surface level; complains of not remembering what was read; poor retrieval; does not generalize from one discipline to another	Top down Alternative endings; compare & contrast; multiple readings; self-generation
Block 2 Integrative	Reading fluency with prosody Reading fluency: mechanical Literacy appreciation; enjoyment; motivation	Reading of passages RAN Observation e.g. losing place in RAN; skipping lines; pausing to decode; no prosody; anxiety for reading aloud	Bottom up Fluency software; practicing prosody in chunks; literacy menu
Block 1 Sensory	Comprehension of phrases and sentences Word attack skills Letter/word identification Orthographic awareness Phonological awareness Alphabetic principle Literacy awareness	Basic reading skills subtests Pseudoword reading Phonological awareness subtests Sound/letter subtests Observation e.g. poor and inconsistent decoding; poor literacy awareness; lack of motivation & enjoyment about reading	Depends on age and severity of deficit Guided reading; usual basic skills; literacy enjoyment

Math Processes		Methods of Assessment	Methods of Intervention
Block 3 Generative	Math problem-solving	<p>Math problem solving subtests Reading comprehension subtests</p> <p>Observation e.g. spontaneous generation of alternate methods to achieve outcome; over-reliance on mapping of components; knows content but cannot generalize</p>	Top down Rehearsal of basics before beginning; strategy of tools needed
Block 2 Integrative	<p>Math fluency: strategies Math fact fluency Generalization of math to settings</p>	<p>Math fluency subtests Math fact knowledge</p> <p>Observation e.g. inconsistent application of facts; needs prompts; does not check work; anxious about fluency; continued use of visual prompts</p>	Bottom up Rehearsal; same modality in and out; overlearning
Block 1 Sensory	<p>Math operations: awareness Number identification Math literacy appreciation Number sense</p>	<p>Basic math facts Number identification subtests Number sense subtests; basic items on math computation subtests</p> <p>Observation e.g. inconsistent identification of numbers; loses place when trying to order visual objects; unaware of missing items</p>	Depends on age and severity of deficit Number literacy; place

Writing Processes		Methods of Assessment	Methods of Intervention
Block 3 Generative	Written expression: critical Written expression: creative Written expression: concrete	Written expression subtests Observation e.g. can criticize own work; reworks prose; answers literal questions but not inferential; does not enjoy design	Top down Visual mapping of ideas; research skills; incubation skills; patience
Block 2 Integrative	Spelling fluency Grammar fluency Vocabulary Handwriting/typing fluency	Spelling achievement tests: error analyses Written expression subtests: grammar Vocabulary subtests Observation e.g. slowing down to spell; poor advanced organizing; erratic grammar & punctuation	Bottom up Parsimony; basic mapping; vocab software; visual practice
Block 1 Sensory	Grammar rules Spelling generative/rule bound Spelling basic Copying written material Literacy appreciation—need to write	Basic written expression and spelling subtests Pencil grip Copying skills Coloring skills Observation e.g. lack of interest; frustration; poor fine motor; handedness confusion; poor spacing; reversals	Depends on age and severity of deficit Distinguish between literacy and motor

Interventions



Brain Plasticity & Intervention

plas·tic·i·ty definition

•Pronunciation: /pla-^lstis-ət-ē/

Function: *n*

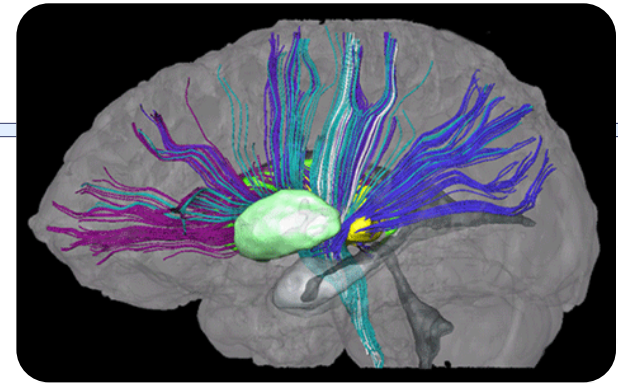
pl -ties ; **1:** the quality or state of being plastic

especially : capacity for being molded or altered

2: the ability to retain a shape attained by pressure deformation

3: the capacity of organisms with the same genotype to vary in developmental pattern, in phenotype, or in behavior according to varying environmental conditions

4: the capacity for continuous alteration of the neural pathways and synapses of the living brain and nervous system in response to experience or injury that involves the formation of new pathways and synapses and the elimination or modification of existing ones



Interventions

- Basic on research about approaches that are found to be evidence-based with groups AND...
- Tailored or individualized to the case at hand
- Sensitive to cognitive fatigue/reserve
- Ongoing
- Monitored
- Adjusted according to progress

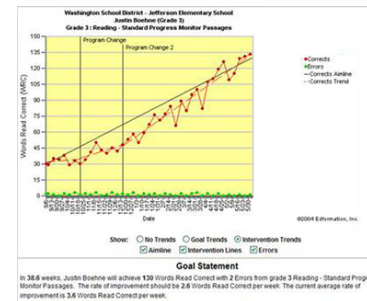


Outcomes & Quality of Life



Outcomes & Quality of Life

- Outcomes based on current status
- Reflective of future developmental needs
- Projective to future placements
- Measured in numerous ways
 - Quantitative
 - Qualitative
 - Child focused
 - Teacher focused
 - Parent focused



Progress Monitoring
Improvement Report — Reading (District)



The Neurodevelopmental Model of



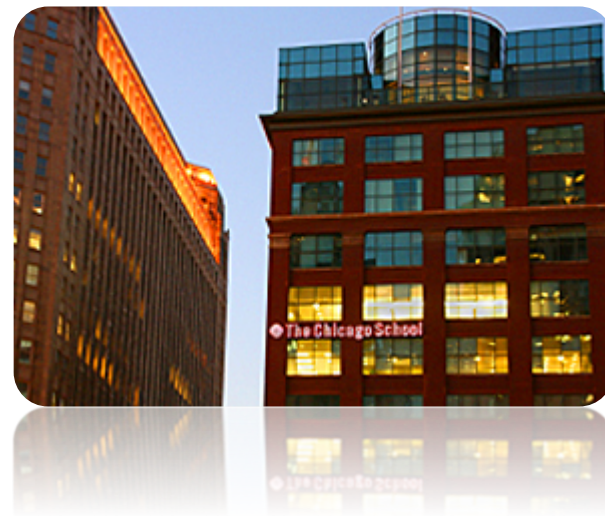
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Contact

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CASE STUDY

Language, Learning or Emotional Disorder?

Josh



- 8-year-old male
- 3rd grade
- Speech-language services since age 3
- ED self-contained since kindergarten
- Lives with Mom, Mom's boyfriend, 2 younger sisters (4 & 5). Bio Dad every other weekend
- 4 –year-old sister has autism

Josh



- Developmental Hx remarkable for bed wetting, ear infections, chronic coughs, constipation, poor articulation, poor communication of ideas
- Passed vision screening, failed hearing screening 2x last fall, passed audiological exam Jan. 2015
- Cries easily, anxious, hypervigilant, oversensitive to criticism
- Curious, loves to play with siblings and other students
- Very low academic grades in reading, writing, math

Josh



- Record Review
- Parent interview
- Classroom observation
- Student interview
- Wechsler Intelligence Scale for Children, Fifth Edition
- Beery-Buktenica Developmental Test of Visual-Motor Integration
- Test of Memory and Learning, Second Edition
- Delis-Kaplan Executive Function System, Trail Making Test
- Comprehensive Executive Function Inventory (P&T)
- Behavior Assessment Scale for Children, Second Edition (P&T)
- Adaptive Behavior Assessment System, Second Edition (P&T)
- Kaufman Test of Educational Achievement, Second Edition

Cognitive Processes

Cognitive Product

	Auditory	Visual	Sensory Motor	Language	Executive Attention	Memory	Social emotional	Reading	Math	Writing
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Josh



- What do we call this?
 - Speech? LD? ED?
- What do we recommend?

Josh



- More case studies...

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Cognitive Processes

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