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Continuing Education for Rehabilitation Professionals

Pediatric TBI: An Introduction

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When a child received a traumatic brain injury…

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- "Traumatic brain injury in childhood is the most prevalent cause of death and long term disability in children and affects all socioeconomic levels" (Bond Chapman, 2006).

The Challenges of Pediatric TBI

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- TBI is leading form of acquired brain injury in children

- The costs of childhood TBI are considerable:
  - To child, pain, suffering, personality change, compromise of ability to learn, poor peer relations, social dysfunction
  - To family, loss of their child, increased burden of parenting
  - To educators, the challenge of teaching children who do not fit a traditional learning disability profile
  - For society, a cohort of marginally employable individuals, socially dysfunctional and lacking in social judgment

The Challenges of Pediatric TBI con't

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- The costs of childhood TBI are largely hidden:
  - For adults, costs are evident around time of injury
  - For children, costs escalate with time since injury
- In childhood TBI, long-term costs are psychosocial ones

Etiology of TBI

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- Birth to Two:
- Falls
- Abuse
- MVA
- Delivery
- Accidents
- Shaken Baby Syndrome (SBS)

What do you want to know??

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- Physician asking what is the prognosis for neuropsychological recovery?
- Parent asking what will happen to my child?
- Attorney wants to know future effects?
- Teacher asks how should we plan?

Kennard Principal

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- “Early brain injury have more successful then the same injury in adulthood”
- Margaret Kennard, M.D.
  - 1938
  - Hemispheric specialization and recovery
  - Plasticity
- CURRENT EVIDENCE DOES NOT SUPPORT THIS!

Model of outcome after childhood TBI includes

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- BIOLOGY
- AGE
- TIME
- PSYCHOSOCIAL RESERVE: RISK AND RESILIENCE

- Domains of outcome after childhood TBI
  - Speech and Language
  - Working Memory
  - Inhibitory Control
  - Prospective Memory
  - Planning
  - Metacognition
  - Social Problem Solving
  - Behavior And Psychosocial Function
  - Social Cognition

- Implications of new research for assessment, education, and rehabilitation of childhood TBI

Model of Outcome After Childhood TBI – Maureen Dennis

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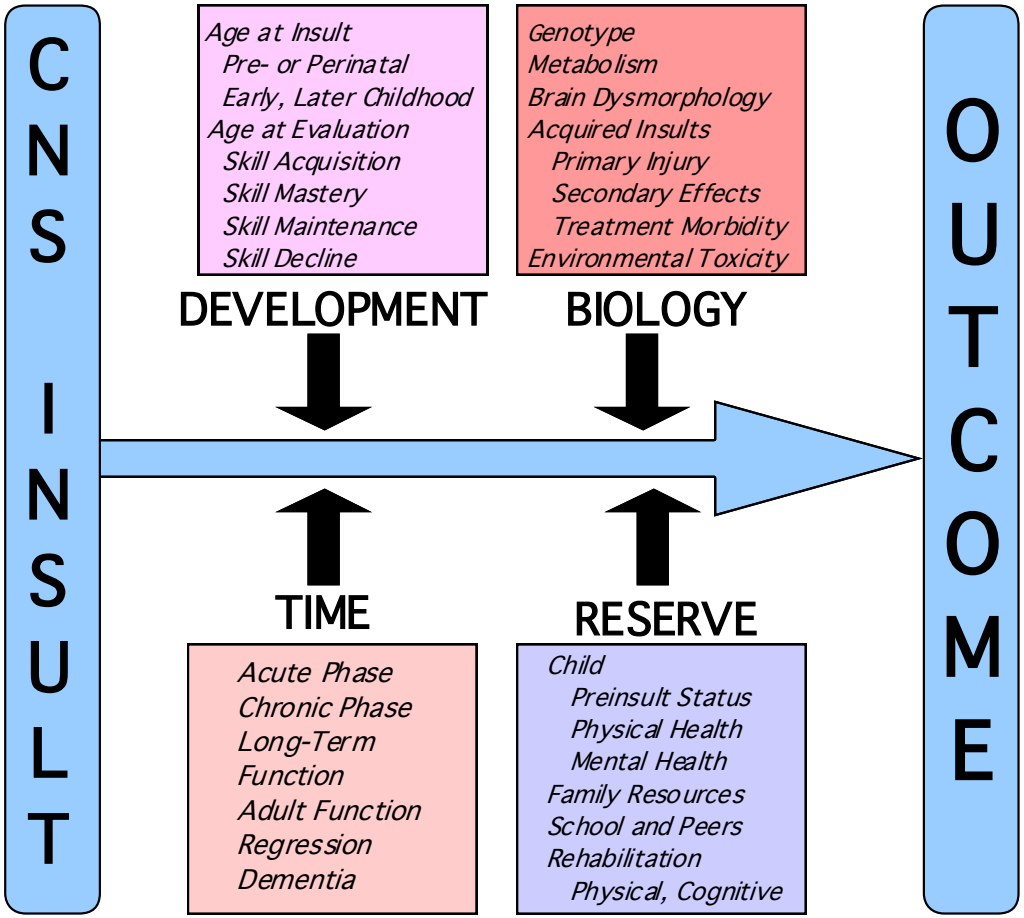
- Biology
  - Severity of TBI
  - Frontal contusions
  - Secondary cascade
- Development
  - Age at TBI
- Time
  - Time Since TBI
- Reserve
  - Cognitive (e.g., working
  - memory, cognitive inhibition)
  - Family & School



Why Is the Model Important?

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- To predict the true risk of cognitive impairment after childhood TBI it is important to consider BIOLOGY, AGE, TIME, and RESERVE
- Reserve in the form of pre-injury characteristics is not equally distributed among children
- Outcome after childhood TBI is shaped by both risks and buffers
- Practical implications for diagnosis and management
- Importance of viewing TBI outcome from a developmental perspective

MODERATORS OF SOCIAL COGNITIVE OUTCOME: SEVERITY

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- Injury severity moderates the effect of TBI on long-term language outcome. Children with severe TBI have difficulty holding conversations, telling stories, producing speech acts, making inferences, and judging communicative adequacy
- Severe TBI is associated with poorer text-level language than was mild TBI, consistent with many head injury severity effects reported in the literature
- Mild TBI is associated with widespread, not selective deficits in social cognition, consistent with reports that mild TBI in children seem to produce fewer lasting cognitive deficits or discourse deficits than do more severe injuries, at least for school-age children and adolescents
- What is unclear is the interaction between age at injury and injury severity in determining outcome

THE IMMATURE FRONTAL LOBES

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- Development is not simply accrual of “adult-like” structures/processes
- Damage to frontal lobes in childhood is different from damage in adulthood

Frontal Injury In Children Is Different From Adults

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- Frontal lobe injury in children involves 3 kinds of brain damage:
  - Focal contusional injury and subsequent brain atrophy
  - Diffuse axonal injury and shearing of frontal lobe white matter and corpus callosum
  - Reduction in brain connectivity, as shown by changes in the directionality and integrity of white matter tracts after TBI

Maureen Dennis (2006)

Age And Cognitive Outcome

Ylvisaker et al 2005

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- Older views assumed a young age to be protective against cognitive impairment
- Prejudice that young age is protective:
  - Clinicians were sent “case” of childhood TBI and asked to rate degree of cognitive impairment
  - Same case, told either older or younger age at TBI
  - Younger age rated as having less impairment, even by experienced clinicians
- New views, supported by empirical research, shows that a younger age at TBI is associated with less optimal outcome

Evidence That Younger Age Produces Poorer Cognitive Outcome

Yeates et al 2007

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- Infants and preschoolers
  - more likely to have compromised intellectual development than older children
  - Show slower rate of recovery and new development
- Effects of TBI in older children are domain-specific; effects in infants and preschoolers are global (lower IQ) as well as specific (in reading), so are more serious
- Effects in infants and preschoolers extend over a longer period of development and education: “Matthew Effects”
- Developmentally sensitive periods for the acquisition of a skill associated with specific deficits
  - Children injured as preschoolers have reading decoding and reading comprehension deficits
  - Children injuries at a later age have comprehension deficits

The recovery process

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- The recovery process for children is more complex than for adults because the child's brain is still developing.

- The rapid physical recovery often seen in children with TBI can be misleading. As the child emerges from coma and progresses with physical, occupational and speech/language therapies, parents often speak of a "miraculous" recovery. Because of this rapid initial progress, families often bring their child home with the expectation that progress will continue until the child reaches a full or almost complete recovery

For the children with a brain injury, time “reveals” rather than “heals” all wounds.

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- The cognitive recovery process for children continues over many years as the child’s brain develops and matures.
- The effects of an earlier injury to any part of the brain may not become fully evident until that area develops and is challenged in the classroom.
- Changes in learning, executive skills and behavior are among the most common long-term effects of brain injuries among children.

Immediate vs Latent Recovery

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- Sandra Chapman uses the term *neurocognitive stall* to describe "…a halting or slowing in later stages of cognitive, social and motor development beyond a year after brain injury.
- Despite a remarkable recovery during the first year after a severe brain injury, the child may appear to 'hit a wall' or 'fail to thrive' in terms of continued cognitive growth.
- "It is not so much that the child loses already acquired skills as it is a failure or lag in development of later emerging cognitive milestones." (Bond Chapman, 2006).

Growing into their deficits

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- Neurocognitive stall
- Frontal lobe development ages 13-25
- Social pressures

Reserve And Cognitive Outcome

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- PRE-INSULT RISKS
  - lower SES
  - lower IQ
  - learning disorder
  - physical, mental health
- POST-INSULT RISKS
  - treatment noncompliance
  - school absences
  - no educational plan
  - no rehabilitation plan

Reserve And Cognitive Outcome

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- PRE-INSULT BUFFERS
  - higher SES
  - higher IQ
  - learning skills
  - physical, mental health
- POST-INSULT BUFFERS
  - treatment compliance
  - school attendance
  - educational plan
  - rehabilitation plan

Socioeconomic & Family Status

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- Resources
- Moms and Dads are not alike
- Family coping
- Education
- Effects on Siblings

Discourse after TBI

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Discourse refers to the use of communication in context

(Dennis & Lovett, 1990)

It is the interaction of cognitive, linguistic and information-processing abilities (Chapman et al., 1999)

Issues in Discourse

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- Load: Proposition-Amount of information provided
- Structural completeness
- Expression of central semantic meaning

Based on narrative discourse-there are limited studies on conversation.

- Pace/ Rate

Social Skills

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- Neuroimaging research has found larger and more numerous lesions in brain regions suggested to be involved with social information processing and regulation of social behavior (frontal and anterior temporal regions).

- The limited research that does exist indicates that children with severe TBI are:
  - Less skilled at social problem solving
  - Rated as less socially competent
  - Found to report concern about losing friends
  - Self-rated as less socially competent and lonelier than children without brain injury
  - Found to report feelings of isolation, low self-esteem, and social unease
  - Found to have poorer social integration
  - Found to demonstrate social discourse problems persisting beyond clinical improvement or resolution of language deficits.
  - Wells et al. (2009) found 80% of participants experienced some level of limitation in their social participation, especially with social activities involving same-aged peers.

- Current findings suggest that poor social outcomes are persistent after childhood TBI.

Social Skills con't
(as compiled by S. Heigy)

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- Social cognition involves:
  - Specific neural structures
  - Genetics (research suggests some differences in social cognition between genders are genetic; evidence from genetic diseases suggests certain gene sets contribute disproportionately to social cognition)
  - Neurotransmitter systems (hypothalamus peptides oxytocin, vasopressin, serotonin, and endogenous opiates)*
  - Culture and environment
- Probable differences in social information processing demands vs. non-social cognition. The social environment stimuli are more complex, less predictable, and more related to one's own behavior than physical environment stimuli.

BRAIN REGIONS INVOLVED IN SOCIAL COGNITION AND EXECUTIVE FUNCTION

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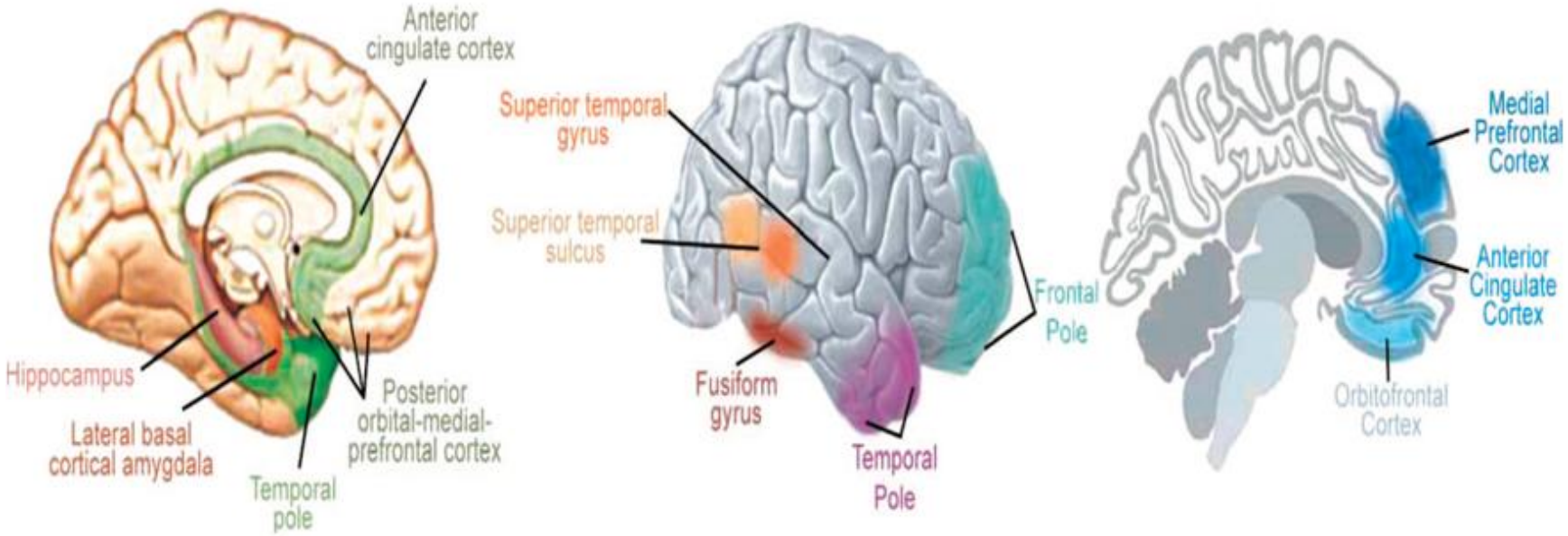

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- Rubin and Rose-Krasnor (1992) define social competence as “the ability to achieve personal goals in social interaction while simultaneously maintaining positive relationships with others over time and across situations.” (10)

Rubin and Rose-Krasnor

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- children with TBI produced few solutions to hypothetical situations involving peer-group entry. Solutions generated were more indirect, less positive, and less assertive.

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- Research findings indicate the need to target specific neurocognitive skills as well as social problem-solving skills as part of a rehabilitation program (both during acute stages and long-term) to indirectly improve social functioning.

What will happen?

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- 5 yr old male
- Traumatic brain injury with initial GCS 10
- Current testing reveals FIQ 85
- Currently at home “doing well”
- Preparing to return to school

- How should the rehab team plan for transition back to school?
- What areas may require intervention from the school based clinicians and teams?

Remember

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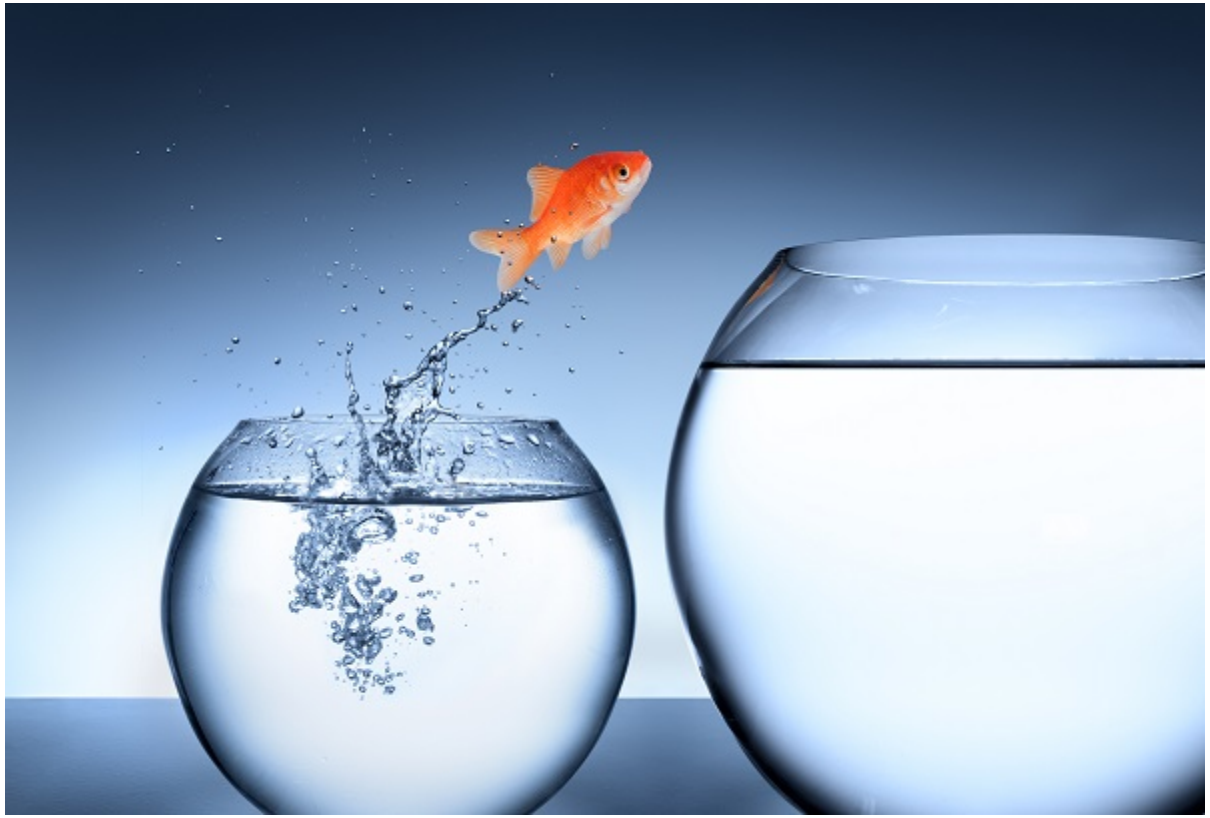
- FAMILY EDUCATION
- Often students with TBI need goals that go beyond any one specific academic area
- Keep goals functionally oriented and outcome-based
- Base goals on the student strengths paired with student need
- Look for changes in any of these areas
- IEP may need to be rewritten every 2-4 months to meet changing needs of student
- State objectives as an increase in positive behaviors rather than the elimination of negative behaviors

Some Goal Examples



Communication

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- Given a topic, Steven will take 4 turns in a conversation before changing the topic in 3 out of 4 trials across 3 settings: in speech therapy, in the classroom and in the hallway.

- Steven will successfully choose an activity and show a picture of that activity to another student as an invitation to play in 4/5 opportunities.

Behavior

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- Jenny will remove herself from a confrontation with a classmate by going to the counselor's office and choosing an activity from her cool down box: 2 out of 3 opportunities during lunch/recess.
- Jenny will learn 5 games to play during recess.
- Jenny will choose a game she knows how to play each recess and play it appropriately in 4/5 opportunities.

Cognition

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- Sarah will rest during 4th period to help keep her alert in 5th, 6th, and 7th periods (accommodation)
  - See memory, attention, abstract thinking, judgment, problem solving, reasoning, information processing and social skills for specific cognition goal examples

Memory

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- After learning 4 memory techniques, Keisha will chose one and use it to recall the names of 5 friends 3 times each week.

- To be better prepared for homework, Keisha will independently record class assignments in a planner and review it at the end of the day with Mr. Green in 100% of opportunities.

Attention

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- Jose will successfully identify attending vs non attending states in others in 5/5 opportunities.
- Jose will successfully identify attending vs non attending personal states in 4/5 opportunities.
- Jose will self-advocate by requesting the elimination of sources of distraction during instruction in an appropriate way 4 out of 5 times two consecutive days.
- Jose will demonstrate the ability to self initiate one attention refocusing strategy in 4/5 opporunities.

Abstract Thinking

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- Given a form to complete, Ginger will make a reasonable inference about a paragraph she has read 4 out of 5 times for 6 weeks in a row.

- After listening to a paragraph from different content areas, Ginger will accurately predict what might happen next in 4/5 opportunities.

Judgment

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- With guidance Diego will use a matrix of choices to determine the best option for herself when deciding between 3 possibilities

- Diego will meet with Ms. Tiggywinkle to discuss 1 choice she plans to make prior to lunch 3 out of 5 days each week.

Problem Solving

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- Tatiana will generate 4 solutions to a problem she has had at recess and choose a solution to try the next recess 3 out of 5 days each week.

- After choosing a problem, Tatiana will meet with his mentor to determine ways to solve the problem.

Reasoning

- Bentley will successfully create a shopping list using the amount of money he has budgeted in 4/5 opportunities.

- With minimal cues, Bentley will use a shopping list he has created to purchase needed items for the week at the store in 4/5 opportunities.

Information Processing

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- Given a prompt or cue, Chester will write his name in less than 30 seconds

- After listening to a story, Chester will retell with pauses of less than 30 seconds, 3 times each week.

Social Skills

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- Alejandra will identify “go” vs “no-go” signs in videotaped discourse in 8/10 opportunities

- When provided with a prompt, Alejandra will demonstrate the ability to follow her social script to express negative reactions to peers in 4/5 opportunities.

Suggested websites for forms, materials and other information

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- http://www.lapublishing.com/attention-process-training-apt1/
- http://www.tbied.org/forms/
- http://www.socialskillstraining.org/
- http://www.minddisorders.com/Py-Z/Social-skills-training.html
- http://www.modelmekids.com/social-skills-training.html
- http://www.lapublishing.com/acquired-brain-injury-school-cds-dvds/

Comments/Questions

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