Memory & Learning:
Effective Instruction for Adults with ABI

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Disclosures

• Dr. Lemoncello receives an honorarium for this presentation.

• ANCDS: TBI EBP committee.
• Board of Directors for OSHA & BIC-NW.

Academy of Neurogenic Communication Sciences & Disorders
www.ancds.org
Evidence-Based Practice (EBP)

- “What Works?”
- “How do we know?”
- “Show me the data!”
Important Research Resources for Memory Rehabilitation

- International Cognitive Group (INCOG) series of guideline papers
  - PTA/delirium, Attention, EF/self-awareness, Cog-Comm, Memory (2014)
- ANCDS series of guideline papers for TBI (www.ancds.org)
  - Sohlberg et al. (2003) – Direct attention training
  - Sohlberg et al. (2008) – External memory aids
  - Ehlhardt et al. (2008) – Systematic Instruction
  - Kennedy et al. (2008) – Meta-cognitive strategies
  - Hopper et al. (2005) – Spaced retrieval (dementia)
Outline

I. Neuroanatomy/Neurophysiology of Memory
   (Break)

II. Principles of Effective Instruction for Cog Rehab

III. Spaced Retrieval for Teaching Facts
   (Lunch)

IV. Systematic Instruction for Teaching Procedures
   (Break)

V. Meta-Cognitive Instruction for Internal Memory Strategies

VI. Cases, Discussion, Wrap-Up, & Conclusions
Learning & Memory Systems in the Brain
(Neuroanatomy/Neurophysiology)

Part I

Learning Objectives:
• Differentiate between working, prospective, and long-term memory systems.
• Describe neurological anatomy, connections, and systems important for memory.
• Describe neuropsychological models of memory.
The many faces of memory...

(Sohlberg & Mateer, 2001)
General Domains of Memory

- **Verbal** Memories
  - Dominant (left) hemisphere processing
- **Visual-Spatial Memories**
  - Non-dominant (right) hemisphere processing
- **Olfactory Memories**
  - Olfactory cortex (orbital frontal lobes; medial temporal lobes)
- **Melodic (Auditory) Memories**
  - Non-dominant (right) hemisphere (temporal lobe)
- **Sensory (tactile) Memories**:
  - Bilateral sensory cortex (parietal lobes)
- **Motor (muscle) Memories**:
  - Bilateral motor programming areas (basal ganglia, cerebellum)
SLP: Importance of Memory for Communication

- Pt. will process, retain, and recall information for...
What is Learning?

• Acquisition of new “stuff”
  – Knowledge, skills, behaviors, strategies...

• Learning requires us to be able to:
  – Take in new stuff
  – Organize new stuff
  – Store new stuff
  – Retrieve the stuff after it’s been stored

• Requires complex interplay between attention, memory, and executive functioning skills
What is Learning? Why do we care?

• Rehabilitation is all about...
  – Re-learning previously mastered knowledge & skills
  – Learning new ways to compensate or work around impairments
  – Learning to adjust to disability
  – And...
The many faces of memory...

(Sohlberg & Mateer, 2001)
What is “Working Memory”?

• The memory formerly known as “short-term” memory (STM)
• NOW, we refer to it as working memory (WM)
  – Related to attention (“working attention”)

• WM = the ability to hold onto & manipulate information
  – Temporary storage
  – Allows for “mental manipulation” (e.g., mental math, syntactic processing of complex sentences, organizational/encoding strategies, reasoning, judgment, thought formulation...)
  – Like the “memory” on a computer (4GB, 8 GB) – not hard drive or LTM

Working Memory Model

- Sensory information decays quickly!
- *Attention* captures sensory info/thoughts ("mind’s eye/ear")
- Central executive *manipulates* info

"Tap each shoulder twice with two fingers while keeping your eyes closed."

(BDAE-3)
Working Memory Limitations

• **Capacity** limited
  7 ± 2 (5-9 chunks of information)

• **Time** limited
  – You can hold onto information as long as you are consciously attending to it
  – As soon as you override capacity or shift your attention, it is “erased” from your mind’s eye/ear

Importance of Working Memory for the SLP

- Process & organize new verbal information to send for storage

- Critical for auditory & reading comprehension of longer/complex material (e.g., note-taking, medication labels)

- Critical for decision-making and judgment (e.g., balancing pros/cons for a decision; generating alternative solutions)

- Critical for conversational pragmatics (e.g., topic maintenance, question answering)
Brain Areas for WM

- Dorsolateral Prefrontal Cortex (DLPFC)
  - Dominant (left) hemisphere for verbal
    - Phonological loop & language/logical decisions
  - Non-Dominant (right) hemisphere for visual
    - Visual-spatial sketchpad & holistic decisions
Can we improve WM?

- **Direct Attention Training** (Sohlberg et al., 2003)
  - Practice Standard  (Cicerone et al., 2011)
    - Intensity of practice
    - Meta-cognitive training
    - Promote generalization

<table>
<thead>
<tr>
<th>Table 2: Remediation of Attention</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intervention</strong></td>
</tr>
<tr>
<td>Remediation of attention is recommended during postacute rehabilitation after TBI. Remediation of attention deficits after TBI should include direct attention training and metacognitive training to promote development of compensatory strategies and foster generalization to real world tasks. Insufficient evidence exists to distinguish the effects of specific attention training during acute recovery and rehabilitation from spontaneous recovery or from more general cognitive interventions. Computer-based interventions may be considered as an adjunct to clinician-guided treatment for the remediation of attention deficits after TBI or stroke. Sole reliance on repeated exposure and practice on computer-based tasks without some involvement and intervention by a therapist is not recommended.</td>
</tr>
<tr>
<td>Practice Standard</td>
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<td>Practice Option</td>
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</tbody>
</table>
The many faces of memory...

(Sohlberg & Mateer, 2001)
What is “Prospective Memory”? 

- **Ability to remember and act on future intentions**
  - “realization of delayed intentions” (Ellis, 1996)

- **Common, functional, everyday memory**

- **Complex** overlap between memory, attention, and executive functioning that requires a set of processes

- **Sensitive to aging changes in functional memory** (Craik & Salthouse, 1992)

- **Often impaired following ABI** (Groot et al., 2002)


Prospective Memory Processes

• Steps of Prospective Memory Processing:
  • Encoding task & time
  • Retention over a delay
  • Retrieval of intention/memory
  • Execution of action
  • Evaluation/monitoring of output effectiveness/efficiency

Subtypes of Prospective Memory

• **Time-Based** Prospective Memory
  – We break for lunch at 12:30 today

• **Event-Based** Prospective Memory
  – When you see Johanna, can you ask her to call me?

• People with ABI have greater difficulty with time-based prospective memory (Groot et al., 2002)

Importance of Prospective Memory for the SLP

• Time management for self-care (medications, appointments, etc)

• Retain and recall important details to communicate for future events (e.g., remember to speak with MD about...)

• Follow through on communication intentions (e.g., remember to tell spouse about a phone call that came in)

• Academic skills: homework completion
Brain Areas for PM

• Requires many interacting areas:
  – Working Memory (DLPFC)
  – Planning, Decision-Making, Judgment (PFC)
  – Inhibitory control (VMPFC)
  – Memory storage (hippocampus)
  – Memory retrieval (PFC)

• *Much overlap with executive functioning & frontal lobe areas!

PFC = prefrontal cortex
DLPFC = dorsolateral prefrontal cortex
VMPFC = ventromedial prefrontal cortex
Can we improve PM?

• Time-Based PM:
  – External Aids with alarms (Lemoncello et al., 2011)

• Event-Based PM:
  – Internal Memory Strategies (Grilli & McFarland, 2011)
The many faces of memory...

(Sohlberg & Mateer, 2001)
What is “Long-Term Memory”? 

• “Information that is stored for considerable periods of time”

• Requires **STORAGE** for later retrieval

• Includes *recent* & *remote* memories
  – Anything that is accessible while not in working memory “buffer”

• Multiple subsystems for processing different types of information
  – Processed in different brain areas

Long Term Memory/Learning: 2 Distinct Memory Systems

**Declarative**
- Learning *WHAT*
- mediated through medial temporal lobes (*hippocampus*)
  - Dominant: verbal
  - Non-Dominant: visual-spatial
- stored in *lateral temporal lobes*

*Often impaired in ABI*

**Non-Declarative**
- Learning *HOW TO DO*
- “muscle memory” & habits
- mediated & modified through *motor areas* (motor planning cortex, basal ganglia, cerebellum)

*Often spared in ABI*
Let’s Focus on Declarative LTM Systems...

- Declarative LTM Memories for Verbal Memory
  - WHAT you can SAY that you know
  - Mediated through dominant (left) hemisphere
  - Two subsystems:
    - **Episodic** Knowledge/Memories
      - Autobiographical information
      - Personal memory for specific “episodes” or events that have context-tags (in time/space)
    - **Semantic** Knowledge/Memories
      - General world knowledge of facts, vocabulary, etc.
Stages of Declarative Learning

(Attention)

Perceptual Encoding

Storage

Retrieval

Initial Acquisition
Maintenance
Generalization

Stages of Declarative Learning

• **Encoding** in sensory/perceptual association areas of cortex (visual, auditory, olfactory, tactile...)
  – Problems: agnosias, slowed processing

• **Storage** mediated through hippocampus
  – Problems: amnesia (retrograde/anterograde)

• **Retrieval** mediated through frontal lobes (triggered by environment or active search)
  – Problems: slowed/difficult free recall (better with recognition), confabulation
Storing New Declarative Knowledge

- Perceptual Cortex
- Hippocampus
- Cortex (temporal lobes)
Hippocampus & Medial Temporal Lobes
How About NON-Declarative LTM Systems?

• Non-Declarative LTM Memories
  – What you can DO
  – Mediated through motor areas (basal ganglia, cerebellum)
  – Two subsystems:
    • **Procedural** Knowledge/Memories
      – Knowing HOW TO DO an activity (e.g., opening a can, riding a bike, entering an appointment into your phone calendar, operating your Dynavox)
      – Skills, Habits, Routines
    • **Perceptual Priming**
      – Means that you are more likely to respond to something based on previous exposure
Importance of LTM for the SLP

- Process, recall, and retain important medical information
- Process, recall, and retain important safety information
- Recall and retain important rehabilitation strategies
- Communicate about personally meaningful topics in conversation with medical staff
- Communicate about personally meaningful topics in conversation with family & friends
- Implement external aid supports to communicate for...
Can we improve Long-Term Declarative Memory Systems?

• Systematic Instruction for specific learning

• Internal Meta-Memory Strategies

• External Memory Aids
Overlap of Cognitive Domains

- **Attention**
  - (ENCODING)

- **Memory**
  - (STORAGE)
  - organization
  - consolidation

- **Executive Functioning**
  - (RETRIEVAL)
Clinical Memory Terminology

• amnesia = specific memory impairment
  – retrograde = unable to recall info prior to injury
  – anterograde = unable to lay down new memories after injury

• confabulation = made-up memories that seem real to the person; false memories not grounded in reality
  – Often with damage to ventral surface of frontal lobes
Memory in TBI

- Relative strengths in:
  - long-term semantic knowledge (pre-injury)
  - non-declarative (procedural) memory systems

- Challenges with:
  - working memory (frontal lobe damage)
  - new declarative learning (hippocampus)
  - free recall of information (frontal lobes)
  - meta-memory/awareness (frontal lobes)
  - prospective memory

- Often benefit from errorless learning, systematic instruction, & routines that capitalize on non-declarative systems!
Memory in RHD

- Relative strengths in:
  - long-term memory systems ("memory" may be ok)
  - verbal skills (verbal working memory, semantic memory)

- Challenges with:
  - attention (focused attention, vigilance)
  - encoding visual information
  - visual-spatial working memory (R frontal lobe damage)
  - free recall of information (frontal lobes)
  - prospective memory

- May benefit from direct attention training, visual scanning treatment, awareness training, organization to enhance perceptual encoding & efficiency of storage/retrieval
Memory in LHD

• Relative strengths in:
  • long-term memory systems ("memory" may be ok)
  • visual skills (visual working memory, visual/spatial memory)

• Challenges with:
  • executive attention
  • encoding verbal information
  • verbal/phonological working memory (L frontal lobe damage)
  • free recall of information (frontal lobes)
  • prospective memory

• May benefit from direct attention training, language (aphasia) treatment, meta strategies for strategic approaches to enhance new learning
Alzheimer’s Disease
Memory in Alzheimer’s Dementia

- Signature/primary presenting problem is memory
- Relative strengths in:
  - retrieval of long-term (remote) memories (reminiscence)
  - non-declarative (procedural) memory systems

- Challenges with:
  - new declarative learning (hippocampus)
  - working memory (frontal lobe damage)
  - loss of semantic knowledge in AD (temporal lobes)
  - free recall of information (frontal lobes)
  - prospective memory

- May benefit from errorless learning, systematic instruction, spaced retrieval techniques, routines, and environmental modifications/supports
Outline

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Principles of Effective Instruction for Cognitive Rehabilitation

Part II

Learning Objective:

• Describe 4 key principles of effective systematic instruction for teaching adults with ABI.

• Specify therapy focus/target you are attempting to address in your cognitive rehabilitation sessions.
Principles of Cognitive Rehabilitation (CR)

• CR is goal-oriented and **solution-focused**
• **Goals** are ever-evolving to build on strengths
• Requires therapeutic alliance & **collaboration** among team (including patient/client/resident)
• Requires **active participation** from all team members
• Focus on **education**, empowerment, and self-control
• CR techniques are **eclectic & individualized**
• Sessions are **structured** and require **careful planning**

(Sohlberg & Mateer, 2001)
Options for Memory Rehabilitation

• Direct attention training
• Metacognitive internal memory strategies
• Systematic Instruction for teaching specific info
• External compensatory aids

• (Environmental modification)
• (Staff/family/partner training)
INCOG
Flowchart: Memory

So let’s talk about **INSTRUCTION**!

- Rehabilitation focuses on training/teaching
  - Regardless of the treatment domain, we are all instructors
- People with cognitive impairments **can** learn new information, skills, and strategies
- Maximizes client success/goal achievement
- Learning requires careful teaching
- “Teaching **IS** rocket science” (Moats, 1999)
What is “Instruction”? 

Teaching 
Guiding 
Coaching 
Mentoring 
Modeling 
Supporting 
Scaffolding 
Showing
A Continuum of Teaching/Learning

Experiential “Discovery” Teaching

Explicit Direct Teaching

Trial-and-Error

Apprentice

Systematic Instruction

Direct Instruction
Instruction with People with Cognitive Impairments

• Attention difficulties
• Storage difficulties
• Disorganized approach to learning
• Difficulty learning from mistakes

*Benefit from systematic, explicit, organized approach to teaching that will maximize learning.
Systematic Instruction

• Roots in Special Education
  – Direct Instruction (DI) program developed at University of Oregon
  – Project Follow-Through showed superior effects of DI curriculum (EBP)

• Assumptions (Kameenui & Simmons)
  – Teaching is complex.
  – Teaching enables learners to do something.
  – A learner’s “behavior” can be changed.
  – Instructor frames problems around controllable variables.

• Think about this:
  – What is it about this learner that makes him/her unable to learn?
  – What is it about this instruction that makes the learner unable to learn?
Key Principles of Effective Instruction

- **Errorless Learning**
  - “Error minimization”
  - (contrast with trial-and-error or wait-and-see approached)

- **Distributed Practice**
  - (contrast with “massed practice”)

- **Active Retrieval**
  - (contrast with passive exposure)

- **Neural Plasticity**
  - Repetition matters!
  - (contrast with many goals with little practice)
Errorless Learning

• **Goal**: Reduce errors during *initial acquisition* for storing new information

• **Enhanced by**: *(Sohlberg, Ehlhardt, & Kennedy, 2005)*
  – High amounts of correct practice
  – Sufficient modeling
  – Minimize guessing but encourage effortful processing
  – Gradual fading of cues/supports
  – Immediate corrective feedback and remodeling

• **Does it work for survivors of ABI?**
  – EL better than ‘errorful’ for learning word lists *(Wilson et al., 1994)* and face-name recall of staff *(Wilson et al., 1994)*
  – EL included in a treatment package effective for teaching new email skills *(Ehlhardt et al., 2005)*
  – EL effects strongest for people with severe memory impairment, especially with poorer declarative memory *(Clare & Jones, 2008)*
Distributed Practice

• Contrast with “massed practice”

• Spacing out practice trials & encouraging active retrieval enhances long-term learning (Maas et al., 2008)

• Distribute learning trials:
  – within sessions (take breaks)
  – across sessions (review, & keep practicing)
Active Retrieval

• Contrast with passive listening/reading
• Active retrieval of memories “strengthens” memory associations
  – reduces threshold for future synapse firing (NMDA-mediated) (“long-term potentiation”)
  – reinforces synaptic connections

• Encourage active retrieval by asking client to generate responses
  – BUT…. could make mistakes...
  – So, need to balance with errorless learning by:
    • Offering cues/scaffolding/supports
    • Minimizing “guessing”
Neural Plasticity Principles

• “Neurons that fire together wire together” (Goodwyn-Craine, 2010)
• “We are trainers of cells” (Rosenbek, 2009)

• Systematic Instruction uses repeated, guided, error-free practice to stimulate “accurate” neural pathway connections so that learning becomes automatic/effortless/over-learned.
Neural Plasticity Principles for ABI

• **Intensive Repetition**
  - Use it or lose it.
  - Use it and improve it.
  - Repetition matters.
  - Intensity matters.

• **Carefully designed rehabilitation program**
  - Salience matters.
  - Hyper-specificity of practice effects on generalization.
    » Transference to related skills
    » May also interfere with learning related skills

Key Principles of Effective Instruction

• **Errorless Learning**
  – “Error minimization”
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• **Distributed Practice**
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• **Active Retrieval**
  – (contrast with passive exposure)

• **Neural Plasticity**
  – Repetition matters!
  – (contrast with many goals with little practice)
Types of Instructional Targets

- Know what type of information/material you are planning to teach.
- Task analyze material to determine pre-requisite knowledge & specific aspects to teach

Types of Instructional Targets:
- **Facts** (e.g., orientation facts, personal information)
  - *Key Instructional Practices* = repetition & distributed practice
- **Concepts** (e.g., functional safety, thickened liquids)
  - *Key Instructional Practices* = define boundaries (what it is & what it is not)
- **Skills/Procedures** (e.g., steps to use assistive device; safe swallowing steps)
  - *Key Instructional Practices* = chain steps together into routine
- **Strategies** (e.g., financial decision-making; anger management)
  - *Key Instructional Practices* = recognize when to implement strategy; self-question
What Will You Treat?

- Generally improve memory?
- Improve working memory?
- Learning facts (names, orientation info)?
- Learning skills/procedures/routines?
- Learning strategies?
- Learning to use an external aid?
- Improving at prospective memory?

- Other???
Some Potential Treatment Targets of Memory Rehab

Restorative/Stimulation at the Impairment Level:

• “improve memory”
  – General memory stimulation does not improve memory!

• Improve attention to tasks, speed of processing, working memory
  – direct attention training

• Learn specific facts, chunks of knowledge
  – spaced retrieval training
Some Potential Treatment Targets of Memory Rehab

Compensatory Targets at the Activity/Participation Level:

• Learning routines/procedures/skills
  – Systematic Instruction

• Remembering appointments & functional info
  – External Aids
  – Internal Meta-Memory strategies

• Remembering to act on future intentions
  – Prospective Memory Process Training (PROMPT)
Practice

• What are some common memory rehabilitation targets that you treat?

• Are you actually targeting:
  – Attention, speed of processing, working memory?
  – New learning of a specific fact, skill, or strategy?
  – Compensations with external aids?
Outline

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Spaced Retrieval: A Technique for Teaching FACTS

Part III

Learning Objectives:

• Identify “fact” treatment targets.
• Describe spaced retrieval procedures for teaching facts to adults with ABI.
Selecting Facts for Rehabilitation

• *Unchanging* bits of information

• Orientation details
  – Personal, biographical information (name, DOB, address)
  – Medical history (type of injury, date of injury)
  – Current living situation (name/address of facility)

• Names of frequently encountered people
  – Family/friends
  – Rehabilitation staff (functional?)

• *Routine* schedule with time associations (meal times, medication times)

• “Rules”

• Other???
Sample Goal Writing for Fact Learning

Client will independently verbalize names of family when shown pictures of individual family members with >90% accuracy across three consecutive sessions.

Client will independently ask nursing staff for medications at regularly scheduled times (8:00am and 6:00pm) at least 9/10 times during a five day period.

Client will remain oriented to place by independently verbalizing the name of this facility when asked where he is living in 4/5 opportunities for five consecutive days.
What is “Spaced Retrieval”? 

• A shaping procedure for remembering “Facts”
• “Spaced Retrieval” is one systematic program for distributed practice (Brush & Camp, 1998)

• Build on successful recalls by increasing delay interval and introducing distractions
  • 30 sec, silent interval
  • 1 min, silent interval
  • 2 min, cancellation task
  • 4 min, cancellation task
  • 8 min, conversational distracter
Instructional Design

- Select functional, meaningful, relevant targets  
  Name Learning
- Assess stage of learning  
  Acquisition
- Identify learning environment  
  Rehab. Hosp.
- Design Materials  
  Pictures of Staff
- Design Wording/Script  
  Variety of ?s
  - Who is your doctor?
  - Your doctor here at the hospital is ___?
  - Whom do you ask for if you’re not feeling well?
  - Whom can you ask about the details of your stroke?
Instructional Delivery

- Modeling
- Practice-Review
- Pacing
- Engagement & Feedback
- Mastery

“This is your doctor, Dr. Homunculus.”

*Introduce Distributed Practice*

***Less Talk, More Practice!!***

Spaced Retrieval TherAppy iOS App (Tactus Therapy Solutions, $3.99)
Spaced Retrieval

• Build on successful recalls by increasing delay interval and introducing distractions
  - 30 sec → 1 min → 2 min → 4 min → 8 min → 15 min → 30 min, etc.

• What do I do during intervals?
  Quiet intervals
  Unrelated non-verbal distraction (card sorting)
  Verbal distraction (divergent naming)

• Mastery = independently recalls after 24 hour delay for 3 consecutive days
# Ongoing Assessment

<table>
<thead>
<tr>
<th>Session #</th>
<th>Initial Probe</th>
<th>Longest Successful Interval</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (AM)</td>
<td>-</td>
<td>3 min; quiet interval</td>
<td>Stuck on “Dr. Brain”</td>
</tr>
<tr>
<td>2 (PM)</td>
<td>-</td>
<td>5 min; non-verbal distractors</td>
<td>Card sorting @ 2 min</td>
</tr>
<tr>
<td>3 (AM)</td>
<td>-</td>
<td>5 min; non-verbal distractors</td>
<td>Card sorting @ 3 min</td>
</tr>
<tr>
<td>4 (PM)</td>
<td>-</td>
<td>10 min; non-verbal distractors</td>
<td>Cancellations @ 3 min</td>
</tr>
<tr>
<td>5 (AM)</td>
<td>-</td>
<td>15 min; non-verbal distractors</td>
<td>Cancellations</td>
</tr>
<tr>
<td>6 (PM)</td>
<td>+ (3 hrs)</td>
<td>15 min; verbal distractors</td>
<td>Harder with verbal tasks</td>
</tr>
<tr>
<td>7 (AM)</td>
<td>- (17 hrs)</td>
<td>30 min; verbal distractors</td>
<td></td>
</tr>
<tr>
<td>8 (PM)</td>
<td>+ (4 hrs)</td>
<td>30 min; verbal distractors</td>
<td></td>
</tr>
<tr>
<td>9 (AM)</td>
<td>+ (18 hrs)</td>
<td>not treated</td>
<td>Feels more confident</td>
</tr>
<tr>
<td>10 (AM)</td>
<td>+ (24 hrs)</td>
<td>not treated</td>
<td>Dr. H reported correct use!</td>
</tr>
</tbody>
</table>
Some Video Examples

– Teaching names during music therapy
– Teaching access/reference to a cue card
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Lunch Break!

I will make the most of my lunch break
I will make the most of my lunch break
I will make the most of my lunch break
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Systematic Instruction for Teaching Procedures

Part IV

Learning Objectives:

• Describe principles of errorless learning for effective instruction of adults with significant cognitive impairments after ABI.

• Describe procedures for chaining steps together when teaching external aids to adults with ABI.
Key Principles of Effective Instruction

• **Errorless Learning**
  – “Error minimization”
  – (contrast with trial-and-error or wait-and-see approached)

• **Distributed Practice**
  – (contrast with “massed practice”)

• **Active Retrieval**
  – (contrast with passive exposure)

• **Neural Plasticity**
  – Repetition matters!
  – (contrast with many goals with little practice)
Chaining Procedures for Multi-Step Procedures/Skills

• Begin with customized task analysis & client-centered wording
• Slowly add one new step at a time
• Link each step to previously mastered step(s)
  – Don’t work in isolation (generally!)
• Goal is to learn the whole procedure
• Forward chaining (add one step at a time)
  \[ 1 \rightarrow 1,2 \rightarrow 1,2,3 \rightarrow 1,2,3,4 \rightarrow 1,2,3,4,5 \]
• Backward chaining (complete whole task each time)
  \[ 1,2,3,4,5 \rightarrow 1,2,3,4,5 \rightarrow 1,2,3,4,5 \rightarrow 1,2,3,4,5 \rightarrow 1,2,3,4,5 \]
Systematic Training Makes a Difference in ABI

• Effective to teach facts & procedures to individuals with moderate-severe learning challenges

• Effective Components of Systematic Instruction:
  – Task analysis (step-by-step instructions; chain together)
  – Prevent errors during initial learning (model - cue - consistent feedback):
    • Errorless Learning
  – Review regularly to reinforce & solidify learning (during session & subsequent sessions)
    • Distributed Practice; Active Retrieval
  – Encourage high numbers of correct repetitions to master skill
    • Neural Plasticity
  – Encourage active learner engagement

(Brush & Camp, 1998; Evans et al., 2000; Sohlberg et al., 2005; Wilson et al., 2001)
Update in Best Practices

- RCT by Ehlhardt-Powell et al. (2012)
- Compared conventional teaching to systematic instruction to teach 29 participants with cognitive impairments (ABI) to use the calendar on a PDA

<table>
<thead>
<tr>
<th>Systematic Instruction</th>
<th>Conventional Instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limited range of instructional targets (calendar program only)</td>
<td>Broad range of instructional targets (calendar program plus )</td>
</tr>
<tr>
<td>Multiple training examples</td>
<td>Few training examples</td>
</tr>
<tr>
<td>Mastery emphasized</td>
<td>Mastery not emphasized</td>
</tr>
<tr>
<td>Exploration discouraged</td>
<td>Exploration encouraged</td>
</tr>
<tr>
<td>Step-by-step models; carefully faded support</td>
<td>Whole task model only</td>
</tr>
<tr>
<td>High rates of correct, distributed practice and review per target</td>
<td>Few practice opportunities per target</td>
</tr>
<tr>
<td>Immediate corrective feedback</td>
<td>Wait to give feedback</td>
</tr>
<tr>
<td>Training in different environments</td>
<td>Training in clinic setting only</td>
</tr>
</tbody>
</table>
ANCOVA Results

Significant difference in mean # tasks correct, controlling for pretest differences

![Bar chart showing results](chart.png)
Types of Procedures you might teach...

• What is functional for your client?

• Multi-step skills
  – External aids
    • Calendars, timers, Day Planners
    • Assistive technology (e.g., voice recorder, PDAs, smart phones)
    • Word processing
  – Activities of daily living (e.g., cooking, dressing, driving)
  – Job-related-filing, answering phones, taking messages, etc.
  – Route finding for routine routes
  – Referring to task-specific checklists to guide performance

• Other???
Goal Writing for Procedures

Client will independently enter appointments into her PDA without cues with 100% accuracy across three consecutive opportunities while in the community, as measured by job coach observation/report.

Client will remember to lift his right foot while using new 4-wheeled walker in his living environment with minimal to no cues from residential staff over 2 weeks, as measured by staff observation when he comes in for his daily meds.

Client will locate where to record information in his memory book with 80% accuracy with minimal to no cues from his trainer (SLP) before moving on to entering appointments himself.
Instructional Design

- Select functional, meaningful, relevant targets
- Assess stage of learning
- Identify learning environment

Design Materials
- Break the task down into component steps
- Select multiple training examples

Design Wording/Script
- Identify instructional wording
  - “Enter your doctor’s appointment.” (presses on button; then turns off)
  - “Step 1--Press the calendar icon.” (instructor presses ‘calendar’ icon)
  - “Again, Step 1---Press the calendar icon.” (instructor demonstrates again)
  - “Your turn. Press the calendar icon.”

External aids
Acquisition
Controlled + Comm
T.A.
Instructional Delivery

- Modeling
- Practice-Review
- Pacing
- Feedback
- Mastery  (chain to next step)
- Training Environment  (program for generalization)
Ongoing Assessment

- Conduct brief “skills check” at the beginning of each session to determine retention.
- Gauge what to focus on in treatment based on the probe.
- If errors emerge, *isolate & model-practice* until firm. Weave back into the skills sequence, as appropriate.

Considerations:
- How many sessions in a row until mastery of one step(s) before moving on?
- What happens if client has a bad day?
- What if client is leaping ahead and already firm with skills you haven’t trained?
Some Video Examples

• Learning to use:
  – External aid notebook
  – Walker
  – Cell phone
In Their Own Words...

“I realize that I NEED supports and will do poorly without them.”

“The anxiety and fear have subsided.”

“I wish I had had this training following my injury. It’s made all the difference.”
Outline

I. Neuroanatomy/Neurophysiology of Memory
II. Principles of Effective Instruction for Cog Rehab
III. Spaced Retrieval for Teaching Facts
IV. Systematic Instruction for Teaching Procedures

V. Meta-Cognitive Instruction for Internal Memory Strategies
VI. Cases, Discussion, Wrap-Up, & Conclusions
Learning Objectives:

- Describe processes involved with metacognitive strategy training.
- Identify two examples of memory strategies for adults with mild memory impairments after ABI.
Meta-Memory Strategies

• Traditional mnemonic training for persons with ABI have demonstrated limited generalization (Richardson, 1995)
  – limited opportunity to employ in everyday life (Glisky & Shacter, 1986)
  – require motivation/insight & strategic use, which are associated with dysexecutive syndrome (Richardson, 1995)

• In order to program for generalization of strategies to everyday life, clinician must address awareness & strategic use / self-monitoring (Kennedy & Coelho, 2005)
Requirements

• Best for those with mild-moderate memory impairments
  – Especially when impairments reflect encoding, working memory, prospective memory, & retrieval more than storage, per se.

• Requires explicit, conscious, deliberate attention, planning, implementation, & monitoring!

• Consider other co-occurring cognitive challenges in:
  – Awareness
  – Initiation
  – Speed of processing
  – Ability to learn from mistakes (executive functioning & memory)
Metacognitive Strategies

- META: think self-directed, self-instructional, self-regulated

Strategy Use

• Depends on knowledge of:
  – **WHEN** to use each tool
  – **HOW** to use each tool
Facilitated by

- Client engagement, effort, & self-developed wording
- Logging/journaling to build awareness, self-efficacy, & motivation
- Bizarre & novel images/stories
- Repetition/rehearsal (SR)
- Explicit planning and practice in natural environments to facilitate generalization
Self-Monitoring of Memory

• Self-monitoring accuracy is critical to making sound strategy decisions (Kennedy, Carney, & Peters, 2003)

• Prediction-Reflection tasks (Sohlberg & Mateer, 2001)
  – Will you remember to complete your daily tasks today?
  – At the end of the day: Check tasks you remembered to complete.

    ~OR~

  – How many items will you remember to purchase at the store? (without list)
  – After shopping: Compare purchased items to listed items.
Strategies: Teaching When and How to use?

- Role Play with a variety of examples to learn when and how to implement tool (positive & negative examples)
- Carefully selected functional role play scenarios
- Natural settings, cues/prompts, feedback as always
- Consider natural opportunities to practice outside of therapy
- Engage a variety of situations & people
Examples of Meta Memory (Internal Memory) Strategies

• Attention directed strategies
  – “pay attention, this is important”
  – How can I help myself remember this?

• Organizational Techniques
  – Acronyms
  – Semantic clustering

• Mnemonics (Association Strategies)
  – Face-name associations
  – Visual imagery & associations
  – Alphabet associations
  – Method of Loci
Self-Anchored Rating Scale Technique

• Solution-focused collaborative assessment/treatment technique grounded in counseling
  – Actively listen to client/care partner perspective
  – One end: Time of ABI (worst)
  – Other end: Goal (best)
  – Then identify, where are you at now?
  – Ask questions that presuppose change & ID resources
    – *What would it take to improve a little bit?*
  – Assignments (noticing, exceptions...)

Goal Writing for Strategy Learning

Client will independently recall important medical information during medical visits using meta-cognitive internal memory strategies to organize and retain new information.

Client will independently self-regulate to avoid anger outbursts during stressful situations in 4/5 role play opportunities for three consecutive sessions.

Client will independently recall important details from homework reading assignments with >85% accuracy when asked comprehension questions following a 24-hour delay for 3 consecutive opportunities.

Client will independently manage finances using a Plan-Do-Review strategy to track bills, write checks, and balance the checkbook each month for two consecutive months.
Instructional Design

- Select functional, meaningful, relevant targets
- Assess stage of learning
- Identify learning environment
- Design Materials
  - Neighbor complains about placement of your trash cans
  - Store clerk asks you to not smoke near entry door
  - Person dials wrong number and you answer at 3:00am

- Design Wording/Script (*collaborate with client for functional examples & wording)
  - “Three C’s”  Control – Choice – Consequences
Instructional Delivery

• Practice-Review  (varied practice; distribute practice)
• Pacing        (increase pace for fluency)
• Feedback      (fade to self-reflection/evaluation)
• Mastery       (fade use of self-talk to silent rehearsal)
Ongoing Assessment

• Does the client recognize opportunities to use the strategy (i.e., know symptoms when anger is on the rise)?

• Can the client recall & implement the steps of the strategy?

• Does the client implement the strategy during clinic role plays?

• Does the client report implementation in everyday life?

• Does the client report implementation in untrained contexts?

• Does the client report improved QOL due to strategy implementation?
It Works!

• Non-randomized controlled trial of adults with TBI (mild-severe)
  – I-MEMS Group (54): 6 week intervention (2x/week, 90-min group tx)
    • Memory education & acquisition, use, and self-monitoring of strategies (semantic ass’n, semantic elaboration, and visual imagery); complement to external memory aids (“Tools in the Toolbox”)
  – Control Group (40): No treatment for memory
• I-MEMS significantly improved memory functioning & maintained 1-month post-Tx
• Mild & moderate > outcomes > severe TBI

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Additional Cases & Discussion
When working with clients with memory impairments...

• Simplify information
• Reduce the amount to be remembered
• Make your points clear
• Encourage memory strategies
• Pause. Review. Check for comprehension.
Melanie

- 56 yo F, complex history, remote TBI, anoxia 2º sleep apnea, trach for overnight CPAP
- Living alone in supportive apartment complex; assistance with cleaning/maintenance
- Participated in SLP as outpatient for cog rehab
- Mild-moderate memory & exec fxn impairments
- We worked on: organizing her space, iPad alarms, routines, internal strategies, signs in apartment, steps to clean and use vent
Brian

• 24yo M, severe TBI 2º MVA, facial paralysis
• Living alone in assisted ABI apartment complex
• Participated in SLP as outpatient for cog rehab
• Severe memory & mild exec fxn impairments
• We worked on: organizing his space, simplifying technology (limited iPhone alarms, notes app), staff training, initiation for social outings
What Do You Think?

• 71yo M, severe TBI 2º fall, hip Fx, IDDM, O₂ (COPD)
• Moderate-severe memory impairments for working memory, prospective memory, and new learning
• Goal: home with spouse

• What might be some functional goals?
• Which ones might you go for independence on?
• How might you go about training these?
• Thoughts for the continuum of care?
Take-Away Mantras

• Neurons that fire together, wire together!
• Less is more!
• Simplify and focus.
• Prioritize a few select targets.
• Practice, practice, practice!
• Scaffold and support for success!
Additional Resources: Books


Some Additional Resources


brainline.org Resources by the Defense & Veterans Brain Injury Center
cbirt.org Center on Brain Injury Research & Training
ancds.org Academy of Neurogenic Communication Disorders & Sciences
speechbite.com Online searchable database for treatment research in SLP
INCOG (2014) Guidelines

Additional Questions?
THANK YOU!