Evidenced-Based Interventions for Impairments of Memory

Rebecca D. Eberle, MA, CCC-SLP, BC-ANCDS
Indiana University – Department of SPHS
rebbeberl@indiana.edu

DISCLOSURES
Rebecca D. Eberle, M.A., CCC-SLP, BC-ANCDS
Has no financial or other interest to disclose

Learning Objectives
• Identify the general guidelines for the use of external memory strategies.
• Define and state the training stages in Memory Notebook procedures.
• Identify types of external memory devices and aids.
• State the procedures for the treatment strategies for severe memory impairment
• Define and state types of metacognitive strategy training for memory impairment.

Outline for the Presentation
• Overview of Memory Systems
• BI-ISIG Recommendations for Memory Impairment
• Determining which Approach to Use: External Compensations or Strategy Training?
• External Compensations
• Strategies for Severe Memory Impairment
• Memory Strategy Training

Components of Memory

Neuroanatomy of Memory

<table>
<thead>
<tr>
<th>BRAIN REGION</th>
<th>MEMORY FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frontal Lobes</td>
<td>Retrieval</td>
</tr>
<tr>
<td>Subcortical Region (hippocampus, amygdala, striatum)</td>
<td>Declarative memory (facts, events)</td>
</tr>
<tr>
<td>Cerebellum, basal ganglia</td>
<td>Procedural memory for motor learning</td>
</tr>
</tbody>
</table>

(Sohlberg & Mateer, 2001)
Stages of Memory Processing

• Registration (sensory memory)
• Short-term memory
  – Immediate memory
  – Working memory
  – Rehearsal
  – Intermediate memory
• Long-term memory
  – Consolidation
  – Learning

Registration

• Holds large mounts of data for seconds
• Modality specific (e.g., visual, auditory)
• Influenced by affect, set (perceptual and response predisposition), and attention-focusing processes

Short-Term Memory

• Immediate memory
  – Simple immediate span of attention (modality-specific)
  – Working memory: “temporary storage & processing system used for problem solving that take place over a limited period of time”
• Rehearsal
  – Repetitive processes to enhance the level of encoding and duration of a memory
• Intermediate memory?
  – 1-2 days but not “permanent”

Organization of Long-term Memory Systems

Declarative
- Conscious recall of objects, information and events

Nondeclarative
- Nonconscious performance of knowledge or skills

Semantic
- Knowledge

Episodic
- Autobiographical experiences or events

Priming
- Cued recall of a previously learned response

Procedural
- “Skill memory”

Other Types of Memory

• Prospective
  – Part of executive functions
  – Remembering to remember
• Source memory
  – Context in which something was learned

BI-ISIG Recommendations for Treatment of Memory Deficits

Practice Standard

Memory strategy training is recommended for mild memory impairments from TBI, including the use of internalized strategies (e.g., visual imagery) and external memory compensations (e.g., notebooks).

Practice Guideline

Use of external compensations with direct application to functional activities is recommended for people with severe memory deficits after TBI or stroke.
BI-ISIG Recommendations for Treatment of Memory Deficits

Practice Options

• For people with severe memory impairments after TBI, errorless learning techniques may be effective for learning specific skills or knowledge, with limited transfer to novel tasks or reduction in overall functional memory problems.

• Group-based interventions may be considered for remediation of memory deficits after TBI.

Approaches to Rehabilitation Memory

<table>
<thead>
<tr>
<th>APPROACHES</th>
<th>TECHNIQUES</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXTERNAL</td>
<td>Orientation notebook</td>
</tr>
<tr>
<td>COMPENSATION</td>
<td>Errorless learning, spaced retrieval, chaining</td>
</tr>
<tr>
<td>Electronic device</td>
<td>Cell phone, pager, alarms</td>
</tr>
<tr>
<td>Memory notebook</td>
<td></td>
</tr>
<tr>
<td>MEMORY</td>
<td>Association Techniques</td>
</tr>
<tr>
<td>STRATEGY TRAINING</td>
<td>Visual-verbal association, visual-verbal</td>
</tr>
<tr>
<td></td>
<td>schematics, visual peg method, Method of Loci</td>
</tr>
<tr>
<td></td>
<td>Organizational &amp; Elaboration Techniques</td>
</tr>
<tr>
<td></td>
<td>First letter mnemonics, semantic clustering,</td>
</tr>
<tr>
<td></td>
<td>PQRST, use of humor, storytelling</td>
</tr>
</tbody>
</table>

Choosing the Right Strategy

Considerations in Choosing a Strategy

• Severity of impairment
• Nature of the information to be remembered
• Functional, personally meaningful tasks
• Patient should understand, have input into goals and strategies—active collaboration.

External Compensations for Memory Impairment

Figure 3.1
Types of External Devices

- Notebooks
- Other written planning systems
- Electronic planners, PDA’s
- Smart cell phones
- Computerized systems
- Auditory or visual systems
- Task-specific aids

Which Type of External Device?

1. The particular task the patient wishes to perform
2. The patient’s goals, abilities, disabilities and preferences
3. The physical features (or limitations) of available technology: audio features, digital options, cost, downloadable apps
4. The environment in which technology is going to be used.
5. The familiarity to the patient.

General Guidelines for External Memory Strategies

- Constant and easy access to the external device or notebook.
- Training of all staff and family members in the use of device.
- Errorless learning techniques and use of procedural memory for severely impaired patients.
- Multiple learning & generalization trials.

General Guidelines for External Memory Strategies, cont’d

- Address any executive dysfunction.
- Apply external devices to functional tasks in the daily life of the patient.
- Use cues early in treatment and fade over time
  - Mild impairment: Rapid fading
  - Severe impairment: Gradual fading

Memory Notebook Types

- Comprises the core of external memory compensations, along with electronic devices.
- Possible sections:
  - Things to do
  - Memory log
  - Daily schedule
  - Homework
  - History and background
  - Handouts
  - Contacts
# Stages in Memory Notebook Training

## Acquisition Stage
**Goal:**
To use notebook in naturalistic settings

**Strategies:**
- Errorless learning, spaced retrieval

**Level of severity determines which strategies are utilized.**

### Severe
- Errorless Learning
- Spaced Retrieval

### Mild
- Question & Answer Rehearsal
- Knowledge Questions

## Application Stage
**Goal:**
To learn the names, purpose, & use of each section

**Strategies:**
- Errorless learning, spaced retrieval

### Question & Answer Rehearsal Samples
- In what section of your Memory Notebook do you plan evening activities?
- In what section of your Memory Notebook do you record future appointments?

### Knowledge Questions
- You should review what you have recorded in the book when ____________
- You should write in the Memory Log when ____________

## Adaptation Stage
**Goal:**
To use notebook on functional tasks in clinic

**Strategies:**
- Feedback, cues, repetition, updating

### Sample Tasks
- Using device to remember to perform a future action:
  - Bring your iPhone to the next therapy session.
  - Tell your family member 1 thing you did at therapy today.
- Using device to store/retrieve sets of information:
  - Dates of upcoming medical appointments.
  - Names and types of medicine used.
- Using device to report information from events/activities:
  - Reporting activities from a visit or past weekend.
  - Reporting information from a work meeting.
Updating and Cleaning Routine

Develop a designated time for review, updating and cleaning of the notebook.

Sequence of Steps:
• Remove old log sheets and place in file.
• Put in the new sheets - logs
• Double check work
• Check the calendar to add any upcoming events

Scoring and Documentation

1. Patient was unable to initiate
2. Patient needed moderate assistance to record & retrieve information during session
3. Patient needed minimum assistance to either record or retrieve information during the session
4. Patient independently recorded & retrieved all relevant activities and information during the session

Strategies for Severe Impairment

Strategies for Severe Memory Impairment: Overview
• Appropriate for clinically important functional skills training, e.g., safe transfers
• Domain specific learning; limited generalization
• Attempts to maximize functioning through recruitment of procedural memory

Effective Strategies for Severe Impairment

Errorless Learning
• Presents information in a way that minimizes the possibility of making mistakes.
• Therapist presents simple information, and requests the patient to immediately repeat.
• More effective when combined with spaced retrieval or with chaining techniques.

Errorless Learning

Errorless Learning
Spaced Retrieval
Chaining
Errorless Learning Training Samples

a. “The names of the notebook’s sections are the schedule, the memory log, and…. What are the names of the sections of your notebook?”
b. “The schedule section of your notebook is for you to record your appointments for the day. What do you record in the schedule section?”
c. The things to do section of your memory notebook is for you to record things you need or want to do that day. What do you record in the things to do section?”

Orientation Page

• Single sheet with all personal information or clinically-relevant information
• Errorless training used in training
• Patient trained to refer to the book/page to answer her/his OWN questions
• Orientation page/book transitioned into MEMORY book when patient ready

 Orientation Page - Sample

Name:__________ Date:______________
My name is ____________________
I am ___ years old
I was born on _____________
My phone number is _______________
Right now I am in the city of ____________
The date today is _______________
Right now I am at a ____________________
I was injured on ____________________
The kind of injury that I have is a _____________
(Others, as driven by the patient’s questions)

Error Elimination Techniques

• Break down the targeted task into small, discrete steps or units.
• Provide sufficient models before the client is asked to perform the target task.
• Encourage the client to avoid guessing.
• Immediately correct errors.
• Carefully fade prompts.

Spaced Retrieval

• Variation in errorless learning
  – patient asked to retain information over progressively longer periods of time e.g., immediate, 15 sec, 30 sec, etc.
• If errors, reduce time between intervals
• Interval time can be quiet or filled with tasks/conversation
• Can be effective for learning specific information (names, room numbers), or strategies (e.g. memory book strategies)

*See Form 3-3, page 51 of the Manual for a spaced retrieval protocol
Spaced Retrieval: Advantages

- Takes advantage of 'distributed practice' by spreading the learning trials over a period of time.
- Can be effective to train people with severe memory impairments to remember specific information.
  1. Strategies, e.g., memory notebooks,
  2. Simple therapeutic procedures (swallowing, transfers, etc.)
  3. Concrete information such as names, of people/places.
  4. Locations of importance (e.g. room number, facility name)
- Generalization is not expected.

Spaced Retrieval Resources

- Screening Test – assists with determination of patient’s appropriateness for technique
- Training Sheet – Assists with data management for determination of time intervals.

Chaining Technique

- Method of teaching patients to perform sequences by means of procedural memory.
- Complex tasks analyzed into multiple steps
- Each step is taught as an isolated unit, automatically with errorless learning, and mechanically linked to other steps
- Each step serves as a cue for the next step
- Occurs without conscious or deliberate intent
*See Form 3-5, pages 54 and 55 for protocol using errorless learning

Forward and Backward Chaining

- Forward chaining:
  - Patient begins with the first step in the sequence and is guided in performing it.
  - Once successful, the second step is introduced and patient performs both together, thereby linking them.
  - This continues forward until task is complete.
- Backward Chaining:
  - Patient begins with the last step in the sequence.
  - Once successful, next to last step is introduced, thereby linking them.
  - This continues backward until patient can perform all steps in sequence.
Memory Strategy Training

- Internal, self-instructional strategies for storage and retrieval of declarative information.
  - Verbal or non-verbal
  - Can be facilitated by external strategies
- Most effective for those with mild to moderate memory impairments

Types of Metacognitive Techniques

- Association
- Elaboration
- Organizational

Encoding strategies

Retrieval strategies
Enhance patient’s ability to find and retrieve information at the time of recall

Association Techniques

<table>
<thead>
<tr>
<th>Technique</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual Peg Method</td>
<td>Target items are linked with a standard set of peg words which are already learned in a set sequence.</td>
</tr>
<tr>
<td>Method of Loci</td>
<td>Linking information to specific (external) visual reference</td>
</tr>
<tr>
<td>Visual Imagery</td>
<td>Linking information to specific (internal) visual reference</td>
</tr>
<tr>
<td>Absurdify</td>
<td>Humor and high levels of interaction make associations stronger</td>
</tr>
</tbody>
</table>

Visual Peg Method Sample

<table>
<thead>
<tr>
<th>Peg Words</th>
<th>Linked Word</th>
<th>Key Image</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - Bun</td>
<td>Bread</td>
<td></td>
</tr>
<tr>
<td>2 - Zoo</td>
<td>Hotdog Buns</td>
<td></td>
</tr>
<tr>
<td>3 - Tree</td>
<td>Soda</td>
<td></td>
</tr>
<tr>
<td>4 - Door</td>
<td>Kleis</td>
<td></td>
</tr>
</tbody>
</table>
Organizational Strategies

First Letter Mnemonics
Use the first letter of each of a series of words to form a single word or pseudo-word.

HOMES = Huron Ontario Michigan Erie Superior

Semantic Clustering
Grouping items in a list into smaller categories

PQRST
Self-instructional technique to learn and recall complex written information

P review
Q uestion
R ead
S tate
T est

Stages of Strategy Training

Acquisition Stage

Step 1: Introduction to technique
- Psycho-education
  - Establish how the strategy will improve their overall effectiveness and independence.
  - Use examples of real-life use

Step 2: Learn the strategy
- Guide patient systematically through use of strategy
- Desired outcome for patients to be able to:
  - Describe the methods
  - Identify tasks and situation for use
  - Be able to recite the steps involved in applying the strategy

Application Stage

• Practice in simple ‘real-life’ or role-play scenarios
• External support begins with high levels and fades with success.
• Recall periods should gradually increase (24, 48, 72 hours, one week)
• Levels of complexity/amount should gradually increase.
• Self generation of techniques.
• Feedback and discussion from both therapist and patient on performance.

Adaptation Stage

• Apply techniques to more complex, functional and everyday tasks, outside the clinic.
• Generalize into ecologically valid environments and tasks.
• Incorporate family and significant others to facilitate and reinforce generalization.
### Application & Adaptation Activities

<table>
<thead>
<tr>
<th>Activity</th>
<th>Application</th>
<th>Adaptation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Face Name Association</td>
<td>Remembering names of the therapists or other patients</td>
<td>Remembering names of classmates, co-workers</td>
</tr>
<tr>
<td>Visual Imagery</td>
<td>Remembering story details</td>
<td>Recalling locations</td>
</tr>
<tr>
<td>Verbal Mnemonics</td>
<td>Remembering grocery lists, to-do lists, steps involved in functional activities</td>
<td>Remembering grocery list when shopping, to-do list</td>
</tr>
<tr>
<td>Organization Strategy</td>
<td>Organizing details from a short article, remembering mock grocery store list</td>
<td>Encode essential details from lectures or textbook, recall items from grocery list by category</td>
</tr>
<tr>
<td>PORST</td>
<td>Remembering newspaper article or job description</td>
<td>Remembering information from lecture or textbook</td>
</tr>
</tbody>
</table>

### Summary of Metacognitive Strategies

- Only for those with mild or mild-moderate level of impairment.
- Client must self-initiate strategy use in real-life environments.
- Some strategies may be difficult to generalize in real environments due to slow processing speed or time pressures.
- Often used in combination with external strategies.

### Memory Rehabilitation Group

- Model described by Thickpenny and Barker-Collow:
  - Didactic teaching about memory and strategies
  - Small group activities
  - Discussions
  - Problem solving
  - Active use of strategies
  - Curriculum based therapy group (Learning Modules); meets 2x/week for 4 weeks.

### TEACH-M

- ‘an instructional package that facilitates learning and retention of multi-step procedures for persons with severe memory and executive function impairments’
- Research results support implementation across a wide range of tasks and contexts.
- Produced ecologically valid outcomes in timely fashion.

Ehhardt et al, 2005; Sohlberg et al, 2005

### TEACH-M Components

- Task analysis
- Errorless learning
- Assess performance
- Cumulative review
- High rates of correct practice trials
- Metacognitive strategy training

Ehhardt et al, 2005; Sohlberg et al, 2005

### Summary of TEACH-M features

- Errorless learning
- Task analysis
- Forward chaining
- Focus on 1 task in-depth
- Cumulative review
- Stimulus pre-exposure
- Prediction-reflection (meta-cognitive strategy)
- Instructor model/guided practice
- Multiple practice opportunities
- Spaced retrieval
- Carefully faded prompts
- Varied training examples
- Training to criterion

Ehhardt et al, 2005; Sohlberg et al, 2005
Case Study and Discussion: Memory

Rebecca D. Eberle, MA, CCC-SLP, BC-ANCDS
Indiana University – Department of SPHS
rebeberl@indiana.edu

Learning Objectives

- Discuss evidenced based options for treating memory deficits.
- Identify examples of behaviors that directly lead to memory intervention selection decisions.
- Provide examples of memory strategies facilitating the adaptation in case studies.
Demographics

- 39 y/o Caucasian Male
- Married with 3 children; all at home initially
- High school graduate, some limited college course work
- Former District Manager for large company in metropolitan area; on disability leave
- Medical History - seemingly good; active athletically, trim; heart murmur as a child

Neuropathology/Rehabilitation

- Cardiac arrest while on vacation.
- Without oxygen for 8 minutes – Severe Anoxia
- Inpatient hospitalization (acute, sub-acute and rehabilitation) = 5 months
- Outpatient therapies (OT/ST) = 5 months
- Home based OT = 4 months
- Referred to University ~ 16 months post onset

Assessment at 1 ½ yr post onset

- **NY evaluation:**
  - revealed profound visual spatial, verbal, geographic, autobiographical memory impairment, moderate impairment in attention and EF, and severe language compromise
  - Lack of progress on re-test after 3 months; discharged with referral for language tx
- **Language assessment (WAB, CADL, ASHA FACS):**
  - Moderate transcortical aphasia
  - Intact syntactic fluency, and repetition
  - Compromised naming, word-finding and auditory comprehension
  - Perseverative verbally
  - Acquired dysgraphia (spelling) & dyscalculia

Functional Impairments and Limitations

- 24 hour supervision – father was primary caregiver – re-tired school teacher.
- Used a magnet board “to-do” list at home with assistance – required cueing
- Unable to provide current autobiographical information; no recollection of day-to-day
- Unable to serve in role as employee, father, home-maker
- Fluent, paraphasic and semantically empty
- Comprehension impairments; required visual prompts and models.
- Very easily confused, lost -> anxious

Strengths and Assets

- FAMILY SUPPORT
- Social Skills
- No physical or visual limitations
- In therapy, and at home on tasks, good sustained attention on activities
- Agreeable, followed lead, and would ask for help
- Positive demeanor
- While compromised, able to talk and write

Client/Family Goals

- Remembering and finding right words
- Aspired to:
  - Stay home alone
  - independence with household management – Productive days
  - Drive
  - Parent his children
  - Volunteer with some independence (morphed from a RTW goal)
Individual Therapy – Decision Making

- **Language** - EB Aphasia therapy
  - Personalized cueing, VNeST, PCA, SFA
  - Aphasia Support Group
- **Memory** - External Aid using Errorless Learning
  - Had been tried repeatedly in other facilities; client knew enough to “not like” a traditionally made small binder with sections (previous memory book); rejected it.
  - History of losing book, and “not using”
- **Family Education/Collaboration**

---

**EB therapy =** Intervention for Severe Memory Impairment with use of External Memory Aid.

---

### Stages of Strategy Training

**Acquisition**
- **Goal:** To learn the names, purpose, & use of each section
- **Strategies:** Errorless learning, spaced retrieval

**Application**
- **Goal:** To use notebook on functional tasks in clinic
- **Strategies:** Feedback, cues, repetition

**Adaptation**
- **Goal:** To use notebook in naturalistic settings
- **Strategies:** Feedback, cues, repetition, updating

---

### Stages in Memory Notebook Training

**Goal:** To use notebook in naturalistic settings

**Strategies:**
- Feedback, cues, repetition, updating

---

### Individualized tasks and tactics

<table>
<thead>
<tr>
<th>Stages</th>
<th>Description of Tactics and tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acquisition</td>
<td>- Choosing, purchasing and setting up personal memory book</td>
</tr>
<tr>
<td></td>
<td>- Training one section at a time, using errorless learning</td>
</tr>
<tr>
<td></td>
<td>- Developing a key for the personalized sections; training consistent use</td>
</tr>
<tr>
<td>Application</td>
<td>- Slowly developing and implementing routines in therapy, and through homework (support from father) for inputting and accessing specific information.</td>
</tr>
<tr>
<td></td>
<td>- Expanded use for more prospective memory purposes</td>
</tr>
<tr>
<td></td>
<td>- Controlling tightly for errors and high success/reward</td>
</tr>
<tr>
<td></td>
<td>- Integrated fully into Aphasia Support Group</td>
</tr>
<tr>
<td>Adaptation</td>
<td>- Expanding routines at home, through support of father</td>
</tr>
<tr>
<td></td>
<td>- Using system on clinic fieldtrips (sport's store, Union Building for sport's wear, golfing...)</td>
</tr>
<tr>
<td></td>
<td>- Heavily integrated in participation in Aphasia Support Group – very powerful in outcome.</td>
</tr>
<tr>
<td></td>
<td>- Consistent use at all home and community activities</td>
</tr>
</tbody>
</table>

---

### Discussion

- What would be appropriate tasks for this client, using goals and strategies provided?
- Considerations given his initial moderate transcortical sensory aphasia?
Examples from KEY

• Your To-Do list tells you all the things that you need to do today.
• *To-Do lists help you to stay organized and to make a plan for your day.
  – *As you check items off, you can keep track of which things you have already finished doing and which things you still need to do.

• Your List of Details is a detailed summary of what you did today.
  – *The extra details help you remember everything that happened today so that you can talk to people about it later.

Outcome

<table>
<thead>
<tr>
<th>Measure</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final Standardized Testing</td>
<td>• RBANS – &lt;1%tile in immed., delayed memory, language; visuo-spatial/constructional 63rd %tile; attention 21st %tile</td>
</tr>
<tr>
<td>Performance in memory and language at clinic &amp; group</td>
<td>• Able to use memory book independently to find and share information, to input information in the correct location and to complete tasks for future need.</td>
</tr>
<tr>
<td>Home and community participation</td>
<td>• Able to converse pertinent information</td>
</tr>
<tr>
<td>&amp; Education</td>
<td>• Able to stay home for ½ days and be independent with basic home-making tasks (lawn-mowing, cleaning..)</td>
</tr>
<tr>
<td>&amp; Engaging as co-clinician</td>
<td>• Re-assumed partial parenting roles</td>
</tr>
<tr>
<td>&amp; Imperative in adaptation stage for this case</td>
<td>• Volunteering 2 hours at a time</td>
</tr>
</tbody>
</table>

Lessons Learned/Reinforced

• Not enough to choose the right intervention – strategic approach
• Outcomes = more than test score
• Get out of the therapy room!
  – Groups
  – Community based therapy
• FAMILY, FAMILY, FAMILY
  – Education
  – Engaging as co-clinician
  – Imperative in adaptation stage for this case