Evidence-Based Interventions for Children's Memory Problems

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Review Quiz

- Review Quiz for Session II

Workshop III Content

1. WM exercises
2. WM strategies
3. LTM Intervention principles
4. LTM strategies
5. Interventions for severe memory impairments

Memory Interventions

1. These are evidence-based; brain-based
2. One-on-one, small group, classroom wide
3. Direct or indirect consultation/training
4. Through trained parents/teachers sometimes
5. Kindergarten through adulthood
6. Exercises vs strategies
7. Accommodations included

Memory Interventions: General Approach

1. Strengthen weakness/deficit if possible
2. But also utilize the strong areas more
3. Use methods that involve other processes, more of the brain
4. Principle: make the brain work; it gets better
5. Training demands prompt strategy use
6. May still need accommodations that reduce the need to rely on the weak processes

Selecting Exercises and Strategies

1. If weak LTM, WM exercises should be included even if WM is normal
    1. WM helps with encoding and retrieval
2. If weak WM, LTM strategies should be included even if LTM is normal
    1. LTM reduces cognitive load and need to retain
3. Executive functions should be strengthened
4. Existing strategies might need re-training

Approaches to Strengthening WM

1. Using LTM to support WM
2. Reducing the learner's cognitive load
3. Using strategies to more effectively use WM
4. Increasing WM capacity through exercises
5. Providing accommodations and support
6. Strengthening attention, executive functions, and related cognitive functions

Rehearsal Strategy

1. Is the subvocal repetition of information
2. Most use this strategy by age 10
3. Applies to both WM and LTM
4. Should be taught to all 1st graders
5. Academic benefits example
6. Students with severe memory problems can not maintain sequence during verbal rehearsal

WM Rehearsal Strategies

1. Goal: Maintain until processing is complete or information encoded
2. Serial and cumulative repetitive process
3. First aloud, then subvocal
4. Increase length of list as student improves
5. Good maintenance if overlearned

Improving Rehearsal Ability

1. Goal is to build span and maintain sequence
2. Have student repeat sequence 4-5 times
3. Listen to see if student maintains correct sequence; “answer” is not necessary
4. Have the student say the words faster

Material for Rehearsal Exercises

1. Use a variety of stimuli
2. Letters phonemes, numbers, words
3. Non-words are ideal
4. Require aloud rehearsal when child can not maintain sequence

Rehearsal (Strategy) Training Steps

1. Serial: present all items at once
2. Cumulative: Repeat first word until next delivered then keep adding words
3. First aloud, then whisper, then subvocal, then check to see if student using
4. Student needs to learn when to use this
5. Remind students when to use this
6. Practice cumulative rehearsal

Using Rehearsal with Switching

1. Switching back and forth between the processing and rehearsal
2. Switching with rehearsal helps maintain the information in STM while processing the same or other information
3. Require trainee to use rehearsal with switching for most WM exercises
4. Switching is embedded in all WM exercises

Chunking Strategy

1. Chunk items to be remembered as a whole
2. Chunks expand WM capacity
3. Combining numbers, letters, or words
4. Spelling: letters in syllable become a chunk
5. Chunks become patterns in LTM
6. Continue until chunking is automatic
7. Practice spelling by chunking phonemes into syllables

Computerized and Internet-Based Working Memory Training

1. These are exercises, not strategies
    1. But they prompt the use of a strategy
2. They work because of brain plasticity
3. Evidence that
    1. Untrained WM performance (near transfer) almost always improves
    2. Far transfer to academics: evidence is inconsistent and limited

What is Required to Make a Computerized Exercise Work

1. Must be adaptive
    1. Difficulty level constantly adjusted
    2. Confirmed by research
2. Processing and storage required during the task
3. Consistent high cognitive workloads
    1. Has to be challenging enough
4. Extensive practice over a sustained period of time
    1. 30 minutes a day for 25 days over 5 weeks minimum

How To Use Online WM Exercises

1. These should be incorporated into intervention so that total exercise time is sufficient.
2. Can be done at home under parental guidance; set up a schedule with specific exercises
3. Can do some during your sessions under your account
4. Monitor their progress
5. Talk with child about using strategies and suggest strategies
6. Main concerns: does not follow schedule; no effort; just guessing

Cogmed Training Details

1. Adaptive, game-like, internet-based training, records everything
2. Has preschool, school age, and adult levels
3. 25 sessions, 30 minutes each with 8 exercises out of 12, over 5 weeks
4. Child can do without assistance
5. Does not encourage use of strategies
6. Video

Research on Cogmed Training

1. Improved WM, especially visual-spatial
2. Fluid reasoning sometimes improved
3. Math sometimes improved
4. Parents reported reduction in motor activity
5. ADHD children improved in WM
6. Holmes et al. found substantial and sustained gains in WM and math
7. Two recent reviews have concluded that the claims are “largely unsubstantiated”
8. Recent study with proper design: WM improved

Lumosity

1. Numerous exercises; more than memory
2. Has N-Back exercises (that's why it's recommended)
3. Exercises based on research
4. Are adaptive and appropriate
5. Affordable plans, such as yearly
6. Can monitor learner's progress
7. Best to select appropriate games rather than allow Lumosity to control individual's program
8. Lumosity requires 13 years of age to use

Brain HQ

1. Affordable plans, such as yearly
2. Variety of WM exercises
3. Well designed, challenging, cover a wide range of ability and age
4. Has verbal WM exercises, e.g., listening to a conversation
5. See examples

Guidelines for Selecting WM Apps

1. Consistent high cognitive workloads
2. Processing and storage required during task
3. Program is adaptive; keeps records
4. Extensive practice time
5. Consistent with evidence-base; such as n-back
6. More than visual-spatial; some kind of verbal processing and retention required
7. Encourages a conscious strategy
8. N-Back app for adults very difficult

Problems with Online Training

1. Do not encourage strategies
2. May not be challenging enough
3. Don’t match well with learner’s WM needs
4. Motivation and guessing
5. Not all are research based
6. Timed responding; too quick
7. No oral to oral exercises

Why Face-to-Face, WM Exercises

1. Compliance with online training is a concern
2. Oral responding not allowed online
3. Online training does not combine exercises and strategies
4. A trainer, parent, or peer administers these
5. Can be done with a student partner who knows the rules; take turns
6. Adapt with a longer span as progress is made

Guidelines for Hands-On, WM Exercises

1. 20-30 minutes a day, every other day
2. About 5 minutes with each type of exercise
3. When span of a given length is mastered, increase the span
4. Lower the span when it is too difficult
5. Require child to use rehearsal and switching strategies
6. Weight training analogy

Counting Span

1. Ideal for young children, preschool
2. Make cards with a variety of dots
3. Have dots of a different color as distractors
4. Count the number of dots on each card
5. Remember the total on each card in correct sequence
6. See example

Span Recall Practice

1. Ideal for young children
2. Practice remembering sequences of words, digits, nonwords
3. Nonwords are more challenging
4. Or sentences; can recall more words in a sentence than in unrelated list

Last Word

1. The task: remember the last words in sequence.
2. Short sentences presented orally.
3. The processing: the trainee must answer a question
4. Example: “Do cats bark?” “Do cars have different shapes?” Then, trainee says, “Bark, shapes.” Practice Link

Using Math to Build WM

- Complete calculations
- Remember the answers in sequence

  4 + 3 = 7

  9 – 3 = 6

  8 + 2 = 10

  Response: 7, 6, 10

- With groups, call on one student randomly for response

Using Math Flashcard to Build WM

1. See rules/procedures
2. Best to use more than one operation in same deck
3. Teach trainee to switch and use cumulative rehearsal
4. How should calculation errors be handled?
5. Practice

N-Back Exercise

1. Found to have corresponding growth in brain
2. Challenging task but easily administered
3. Remember stimulus n-items back
4. Do it repetitively
5. Deck of cards ideal; prevents practice effects
6. *n*-back task
7. What is the strategy?
8. Improvement will be slow at this task
9. See rules/procedures
10. Practice

N-Back Procedures Summary

1. Display items one at a time for 1-2 seconds
2. Start over after 1st error
3. Should get 10 consecutive correct 3 times before going to next *N*
4. 5+ minutes, 4 times per week
5. More challenging: A double *n*-back
6. Establish baseline
7. Encourage strategy use
8. What other materials can be used?

Discussion

1. Which face to face exercises would you do with your students?
2. How could you make one of the exercises a game that students could play with each other in pairs?

Metamemory Overview

1. Teach child how memory works and its limitations
2. Inform child of personal strengths and weaknesses
3. Teach child self-awareness
4. Teach about how we can control memory

Video I

Why is Metamemory Training Essential?

1. Without it, there is:
    1. Less motivation and cooperation
    2. Continued misconceptions and frustration
    3. Less maintenance and generalization
2. Example of 47 year old case

More on Metamemory

1. This is ongoing through sessions
2. Always help child understand why, when, where it works or will benefit (conditional knowledge)
3. Always show the child the data
4. Reinforce progress
5. Child should become expert on memory
6. The older the child, the more metamemory

Metamemory Parent Consultation

In instances where you are unable to meet with the child, how would you advise a parent to discuss memory with an elementary student, with the goal of increasing the child's metamemory?

Demonstrating Efficacy of Interventions

1. Differs by age level
2. Lower Level: Memorize word list versus memorize list while visualizing the object
3. Upper Level: Organizational strategy
    1. Memorize random words
    2. Memorize words arranged in categories
    3. Dramatic improvement is convincing
4. Important for maintenance I II
5. How else can you document efficacy for trainee?

How to Collect Data and Document Progress

1. Pre and post standardized testing (not the best)
2. Rating scales before, during, and after, e.g., CPPS
3. Track recall on material used with new strategies and compare with old/non-strategic learning
4. Monitor acad. performance, e.g., homework
5. Assess attention/executive functions
6. Collect classroom test scores

Bypassing WM with LTM Strategies

1. With severe WM deficits, it is sometimes helpful to bypass WM training and focus on LTM strategies that improve learning, retention, and performance
2. This means going directly to learning and using memory strategies that are generally considered LTM strategies

LTM Intervention Approaches

1. Working memory (enhances LTM encoding)
2. Executive functions; metamemory
3. Strategies and mnemonics to make better use of existing abilities
4. There are no LTM exercises
5. Memory aids and accommodations
6. Effective instruction, such as DI
7. Health and physical variables

LTM Strategies

1. Some are content specific
2. Some take more practice than others
3. Teachers/ trainers need to know why the strategy works and share this with student

Dehn's Big Six LTM Intervention Principles

1. Deeper processing; e.g. elaboration
2. Visualization; e.g. dual encoding
3. Organization; e.g., semantic clustering
4. Associations, linking; e.g., mnemonics
5. Review and retrieve; e.g., testing effect
6. Metamemory

Organizing Information as You Study

1. Works because of deeper processing, correct linking with prior knowledge
2. Organize information in a manner that makes sense to you
3. Examples: a timeline, by subject, category, etc.

Organization: Semantic Clustering

1. Group items by category
2. Works because recognition is stronger than less-cued retrieval
3. First organize, then memorize category names, then review items under each category, including number of items in each category
4. When retrieving, focus on category names first
5. If missing items, run through list, examples of that category in your head and you may recognize the item See I II

Visualization: Dual Encoding

1. Instructors should make it both verbal and visual or give students time to recode
2. Instruct students to visualize verbal info.
3. Instruction students to name/describe visual-spatial info.
4. Increases the number of pathways available for retrieval

Visualization

1. The process of visualizing verbal information
2. For young children, teacher/trainer may provide picture of or describe an image
3. Others should visualize and then describe
4. Retrieved as a visual-spatial item; leads to recall of verbal information
5. For best results create effective visual images
6. Practice visualizing word list

Visualizing and Reading Comprehension

1. Direct student to visualize while reading
2. Should pause frequently and deliberately create imagery if this does not happen automatically
3. Have student describe the images (different than verbally retelling the story)

Reading: Imagining Self in Scene

1. Imagining yourself in the scene, viewing things as if you were actually there
    1. Imagine details and feelings
    2. For literature, social studies
2. Why does it work?

Linking

1. Linking two items to be remembered together in an image is effective
2. But linking while using the structure of mnemonic is more effective because the items are then associated with something you won't forget
3. Practice linking word list
4. Verbal linking is okay; but it is better with an image

Associations: Visual Mnemonics

1. Different from visualizing
2. Works because information is linked to something already known that will not be forgotten
3. Acts as a scaffold or bridge
4. Verbal mnemonics, such as acronyms do not work well for those with verbal memory problems

Visual Mnemonic Images That Are Effective

1. Should be linked/interactive, not just imagined side-by-side
2. Funny, weird, etc.
3. Personal
4. Focused
5. Created by user

Loci (The Palace Technique)

1. Romans matched items with a route
2. Evolved into the Palace method
3. Works with literature, social studies, psychology, lists, etc.
4. Use your home, school building, etc.; can be from past
5. Go through rooms and object in order
6. See video (Andi Bell on Youtube)

Practice Loci

1. With children, use objects in their bedroom
2. Or, go through house/apartment rooms in sequence and link items
3. Practice:
    1. Exports from a mythical African nation: cattle, oil, diamonds, cotton, frogs, gold, snakes, coffee
4. Students really like this method and it works
5. Almost no review required;

Keyword

1. Highly effective; largest effect size, about 1.6
2. Combines auditory and visual
3. First, the acoustical link (keyword)
4. Then, image of linked items interacting
5. To retrieve, think of keyword first
6. LD do better when keyword & image provided
7. See Training Manual p. 59; HSR Upper Level Lesson 40

Keyword Practice

1. Video illustrates a “double” keyword
2. Use keywords for Denver, Colorado
3. Single Keyword practice with Spanish vocab:
    1. Vaca = cow
    2. Carta = letter
    3. Escalera = ladder
4. Make the images unique, interactive, but focused on the keyword and meaning

Pegword

1. Set up pegwords, “One is a bun, Two is a shoe”
2. To be remembered items are visualized with bun, and so on
3. Training Manual p. 60; HSR Lesson 26
4. *Practice*: Grocery list of carrots, bread, ketchup, beer, hot dogs

Elaboration

1. In memory, means explicit, conscious linking of prior knowledge with new information
    1. “Fire together, wire together” principle
2. Strengthens encoding, organization, consolidation, retrieval
3. Teachers should provide for young child but can be done by self with older students
4. Advance organizers are a type of elaboration

Elaboration: Why Question

1. With self application, answering the why question is most effective
2. Student asks and answers:
    1. “Why does this make sense” or
    2. “Why is this true”
3. Explain to a student how to use the why question

Elaboration and Reading Comprehension

1. Student previews and skims the passage
2. Student thinks about what he/she knows about the topic
3. Student pauses after each paragraph, identifies the most important information
4. Students asks and answers the “why” question about that important piece
5. An alternative is KWL

Periodic Review with Expanding Interval

1. Reviewing strengthens memories, but can also change them
2. For tests, at least 3 reviews is recommended and not on the same day
3. Do not guess when reviewing (error learning)
4. Expanding interval works best
    1. Because it's better if it takes effort to recall

Expanding Interval Review

1. More efficient than massed/daily review
2. Strengthens neural pathways
3. Increases learning by 15%
4. Builds on remembered information
5. Supports consolidation & semantic memory
6. Information must actually be retrieved; best when effortful retrieval needed
7. Review should be about the time information is beginning to decay
    1. E.g., 1, 2, 4 days, 1, 2, 4 week intervals

The Retrieval Principle

1. Retrieve from LTM, not STM
2. More effective than just reviewing
3. More effective when info is partially forgotten and it takes effort to retrieve
4. Also strengthens recall for related info.
5. Supports consolidation and reconsolidation
6. Why does it work?
7. Explain to an adolescent how to apply this principle

Periodic Testing

1. Extremely effective
2. First quiz immediately or within a day
3. Expanding intervals like periodic review
4. Not limited to items actually tested
5. Can be self-testing
6. See Training Manual p. 65; HSR Lesson 33
7. Why does it work?
8. Can be self-testing; *explain how to student*

Creating and Using Review Sheets

1. As much a study skill as an LTM method
2. Why does it work from a memory principle perspective?

3. Link

Using Flashcards Effectively

1. Main principles:
    1. Processing required to create them
    2. Periodic review
    3. Sorting into know and don’t know
    4. Retrieval required
    5. Mixes up serial position effects

Context Cues

1. Within the first week or so, retrieval of info is from episodic memory, not semantic
2. Episodic cues facilitate recall: smell, objects, colors, feelings, etc.
3. Testing in an environment other than the actual learning environment lowers test scores
4. Teach students to recall the environment when they are tested elsewhere

Student Feedback After Memory Intervention

- “Hannah”
- Results Link

Severe Memory Impairments

1. Less cognitive load
2. Rely primarily on verbal or visual-spatial with recoding
3. Longer, more intense training
4. More practice with strategies
5. Modified exercises and strategies
6. More support, e.g. prompts
7. Deliver information “just in time”
8. Reduce error learning
9. Reduce interference
10. Recognition testing
11. Bypass WM with long-term memory strategies

Severe Memory Impairments

1. Avoid WM overload when training
2. Tie more directly to academic and daily skills
3. More daily life memory functions
4. Limit number of strategies
5. Mnemonics may be less effective
6. Train parent to support
7. Aides, accommodations, technology
8. See Training Manual p. 73 HSR 38

External Memory Aides

1. Diaries or journals
2. Memory books or memory notebooks
3. Alarms and timers
4. Reminders provided by computers
5. Schedules and assignment calendars
6. Checklists with step-by-step procedures
7. Folders for organizing notes and materials
8. Lists of activities that need to be completed
9. Step-by-step instructions for using a strategy
10. See page 73 in Manual

Memory Book

1. Contains important information that is difficult to remember
2. Schedule (for everything)
3. Procedures for completing tasks
4. Procedures for memory methods
5. Contact information
6. Photos
7. Personalize and continue to add to
8. See page 73 and HSR Lesson 39 and discuss

Reducing Interference

1. Avoid similarity and too much info at once
2. Switch topics
3. Take breaks
4. Take naps
5. Study before sleep
6. Quiet environment

Reducing the Learning of Errors

1. Reduce learning of errors
2. Unlearning of errors is difficult
3. Especially for severe amnesic cases
4. Prevent guessing; supply most of the answer
5. Allows learning through implicit system
6. See Training Manual p. 68

Procedural (Implicit) Learning

1. Cases of amnesia, partial amnesia, severe LTM impairments can learn and remember procedures better than explicit memories
2. Won't remember learning it or that they know it but can perform when prompted to do so
3. Thus, do more procedural training
4. Example: Case with lead poisoning

Context Cues

1. Within the first week or so, retrieval of info is from episodic memory, not semantic
2. Episodic cues facilitate recall: smell, objects, colors, feelings, etc.
3. Testing in an environment other than the actual learning environment lowers test scores by as much as 30%
4. Teach students to recall the environment when they are tested elsewhere

Music

1. Verbal information set to music is retained well
2. However, it is difficult for children to put the information into lyrics that go with a known melody
3. Music lessons early in life have been shown to strengthen memory development overall

Accommodations for Testing

1. Inform student of exam dates well in advance to allow for periodic review
2. Provide review sheets in same format as tests
3. Provide notes of lectures
4. Allow students procedural checklists
5. Recognition testing: word banks, etc.
6. Extended time on testing; notes during test

Improving Recall During Tests

1. Testing accommodations
2. Context cues
3. Elaboration
4. Take time
5. Recognition
6. *Which two recommendations are most important to share with students?*

Health Supports for Memory

1. Reduce risk of concussion
2. Control seizures
3. Treat disorders; medication for depression
4. No illicit drugs
5. Maintain steady glucose level
6. Exercise
7. Reduce stress and anxiety
8. Interference breaks

Sleep Benefits

1. Sleep deprivation harms recall
2. Naps enhance recall
3. Study, review, practice just before sleep leads to better recall
    1. Retroactive interference eliminated
    2. Material ready for consolidation
4. See Training Manual p. 72

Benefits of Exercise

1. Many studies document the benefits of aerobic exercise for maintaining and improving long-term memory in adults
2. Only a couple of studies with children
3. However, children have the same LTM brain structures. Thus, adult benefits should apply to teens and children.

Medications

1. Methylphenidate improves ability to focus and WM performance
2. For LTM in adults with MCI or Alzheimer's medication reduces/slows memory loss
3. These medications may help undiagnosed adults
4. Cholinesterase inhibitor
5. Memantine or Namenda

The Mnemonic Classroom

1. Is a memory-focused classroom
2. Focus on instructional methods that support all memory processes
3. Teacher has memory expertise; understands how LTM functions
4. Educates students about memory
5. Teaches memory strategies/mnemonics
6. Conveys message that you can improve your memory

The Mnemonic Classroom

1. Teacher uses instructional methods that support long-term memory
2. Is aware of what the hippocampus needs
3. Provides interference breaks
4. Reminds students to be memory-focused
5. Knows LTM General Principles
6. Mnemonic instruction improves academic learning

Teacher or Student Strategies in Mnemonic Classroom

1. Repetition
2. Dual encoding, mainly visualizing
3. Elaboration
4. Expanding interval review
5. Testing/Self-Testing
6. Context cues
7. Reducing interference

The Mnemonic Classroom: Examples of Metamemory Instruction

1. There are different types of memory: short-term and long-term; visual and auditory; and personal and academic.
2. Simply desiring to remember something does not make it more memorable; it takes effort, some kind of strategy
3. Using effective memory strategies actually save study time in the long run.
4. Remembering is easier when the information being studied is organized.
5. Remembering is easier when information is encoded both visually and verbally.

How to Encourage Teachers to Be Mnemonic Based

1. *What approach would you use to get the classroom teacher to "buy in"?*

2. *How might you facilitate and support implementation in the classroom?*

Memory Training for Individuals

For working memory and long-term memory

Parent consultation and training available

www.SchoolhouseEducationalServices.com

milt@psychprocesses.com

608-781-0532

Memory Interventionist Training

- For psychologists and related professionals
- Background in psychoeducational assessment required
- Taught by Dr. Dehn
- Taught once per year, beginning in fall
- CEU's from Kids, Inc.
- 36-hour course
- Includes neuropsych assessment of memory
- Case study with supervision
- Details: email milt@psychprocesses.com
- www.SchoolhouseEducationalServices.com