Cognitive Rehabilitation & Emotional Processing Treatment:

Current Research at Kessler Foundation

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Cognitive Changes following TBI and MS

- Executive Functioning
- Processing Speed
- Working Memory Deficits
- Attention Deficits
- Memory dysfunction
  - Cardinal feature post-TBI
  - Common complaint in both MS and TBI
  - Associated with poorer everyday functioning

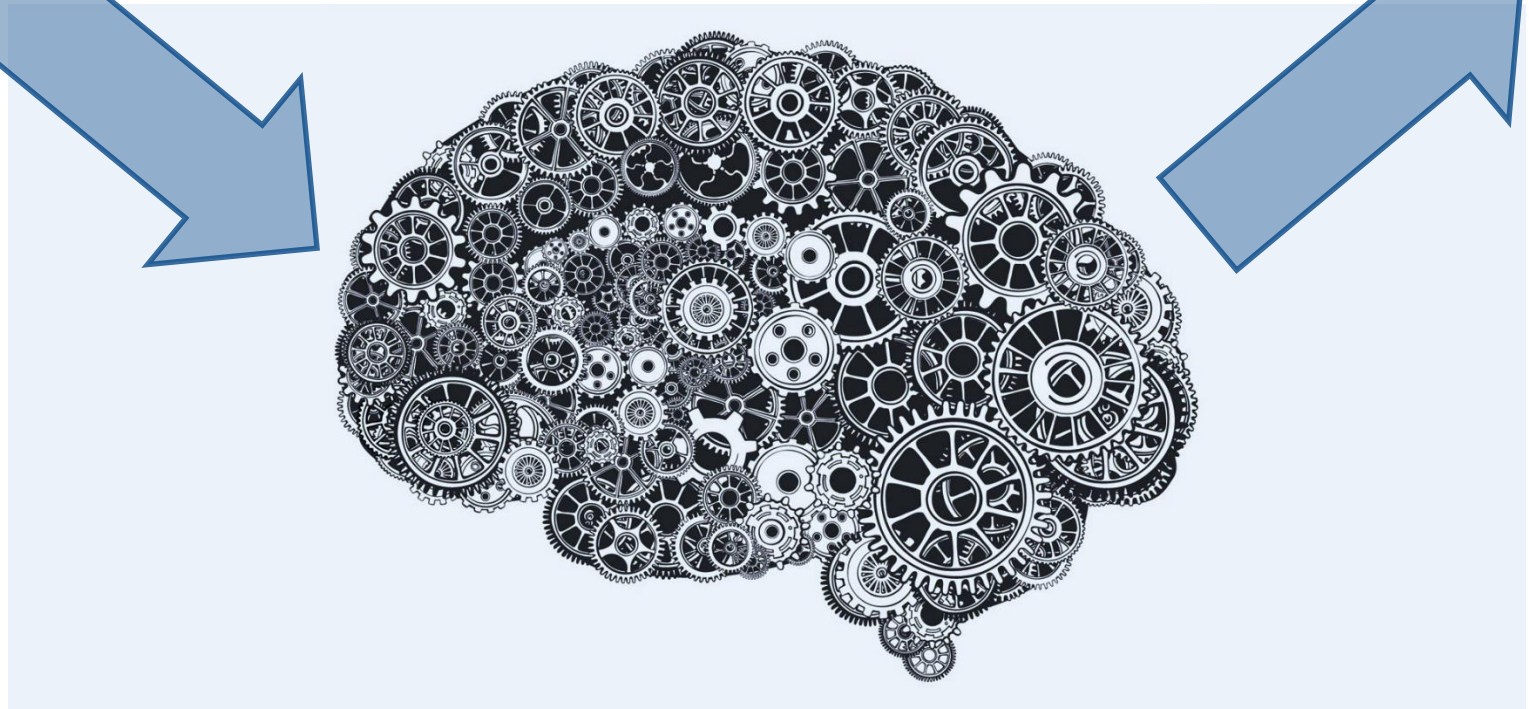
Treatment Protocol 1

New Learning & Memory

Modified Story Memory Technique

Memory Process

Encoding → **Consolidation** → **Retrieval**



Defining Learning

- Learning - “The *process* of acquiring new information”
- Memory - “The *persistence* of learning in a state that can be revealed at a later time”

Squire, 1987

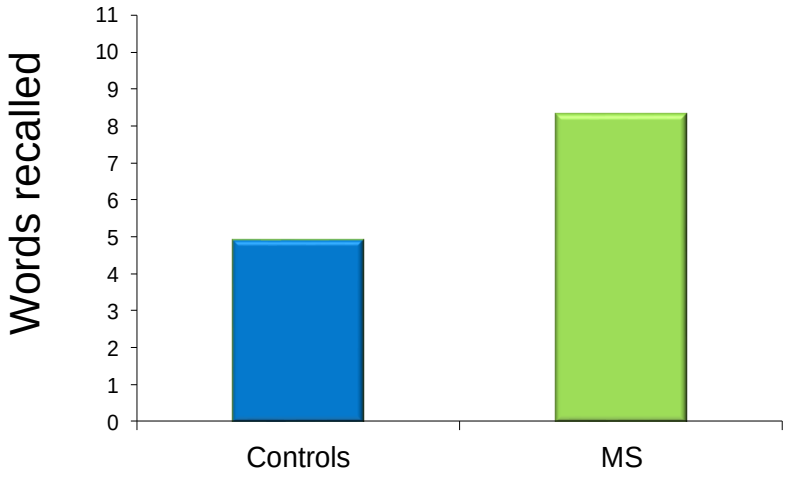
The Nature of Memory Impairments in Multiple Sclerosis: Acquisition vs Retrieval

John DeLuca, Ph.D.
Susan Barbieri-Berger, M.D.
Susan K. Johnson, Ph.D.

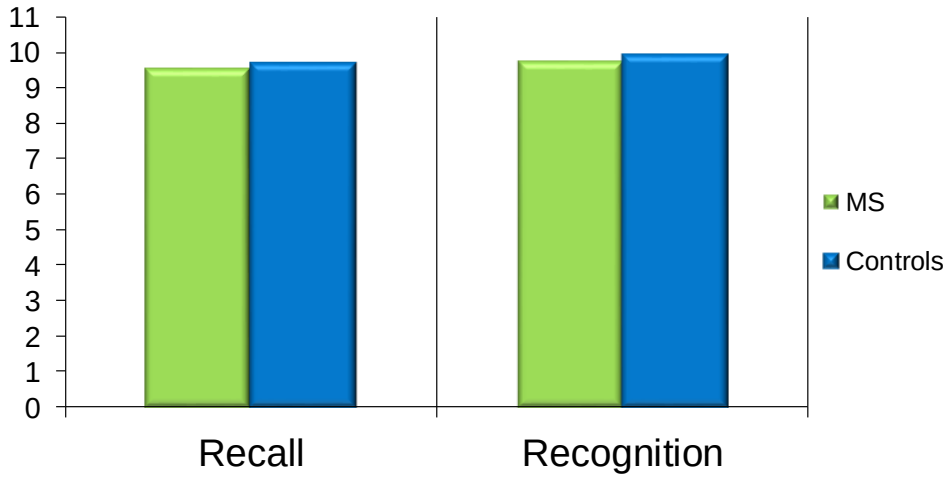
Journal of Clinical and Experimental Neuropsychology, 1994, *16*, 183-189

OT-SRT Trials to Criterion

Trials To Criterion



Recall and Recognition



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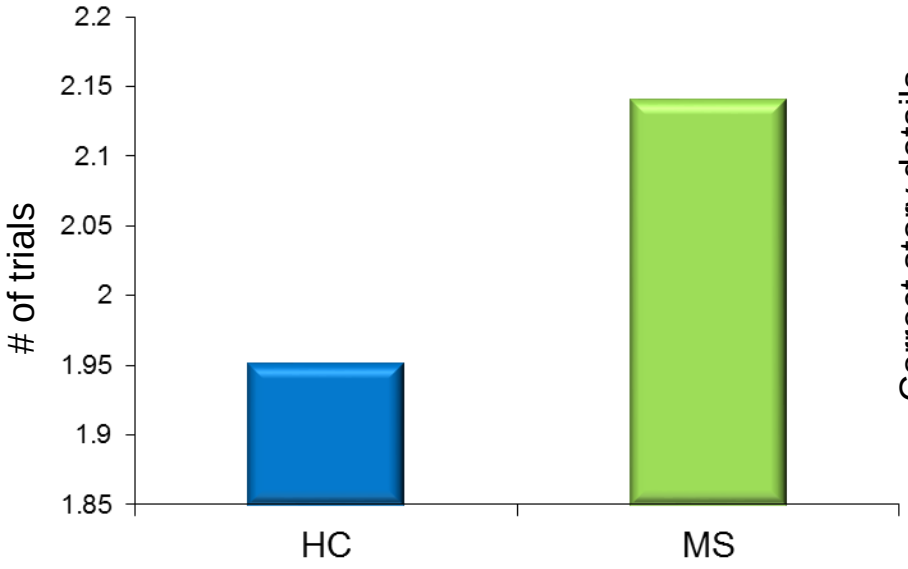
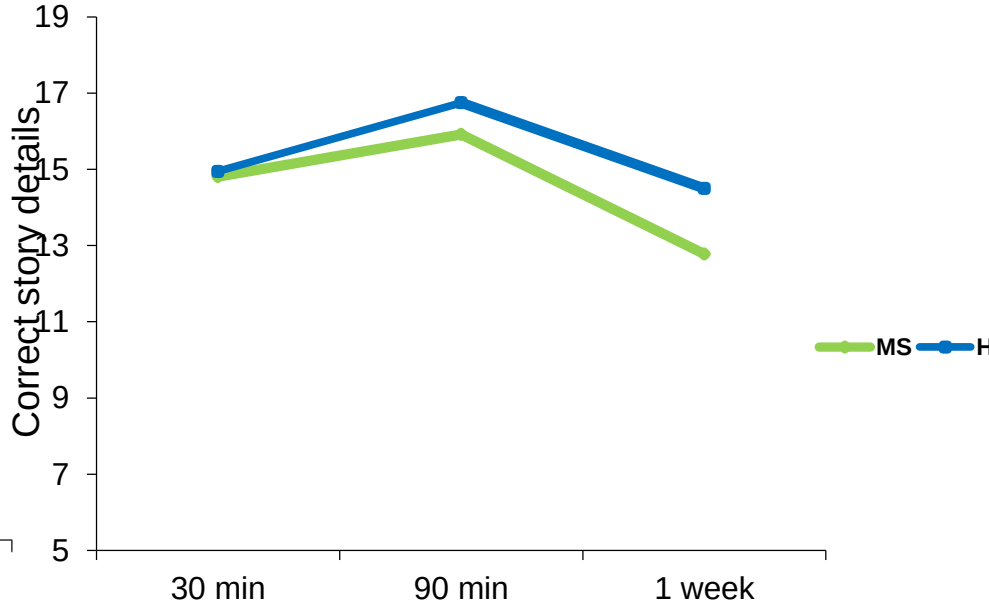
DeLuca et al. (1994) *JCEN*

Logical Memory: Trials to Criterion



Logical Memory: Delayed Recall



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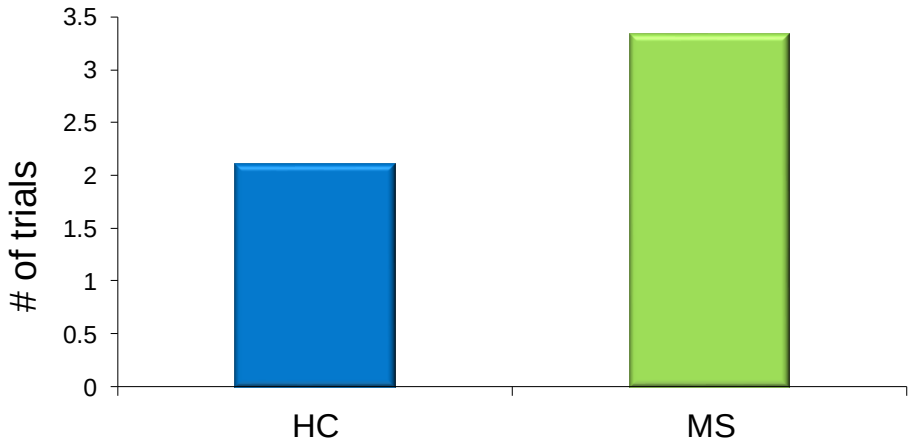
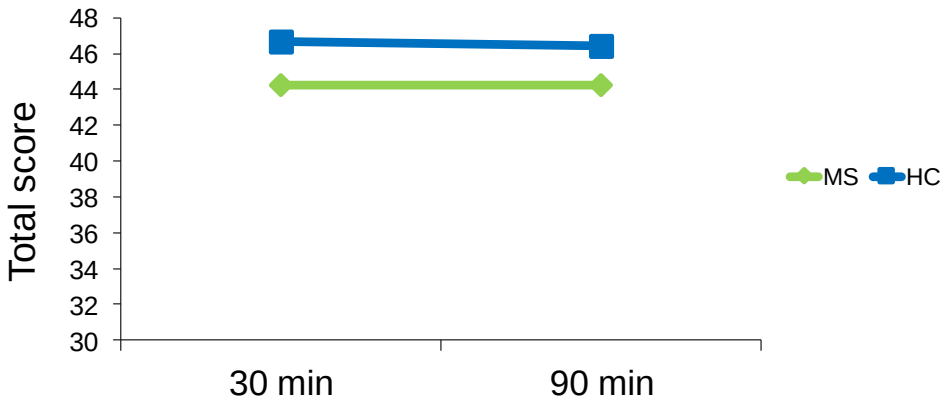
Demaree et al. (2000) *JCEN*

Facial Recognition

Trials to Criterion



Recall



Same pattern seen in TBI

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Demaree et al. (2000) *JCEN*

Learning and Memory

- Primary deficit in MS and TBI is in the acquisition of information

- Goal for rehabilitation:
  - Explore treatments that enhance encoding of information

Modified Story Memory Technique (mSMT)

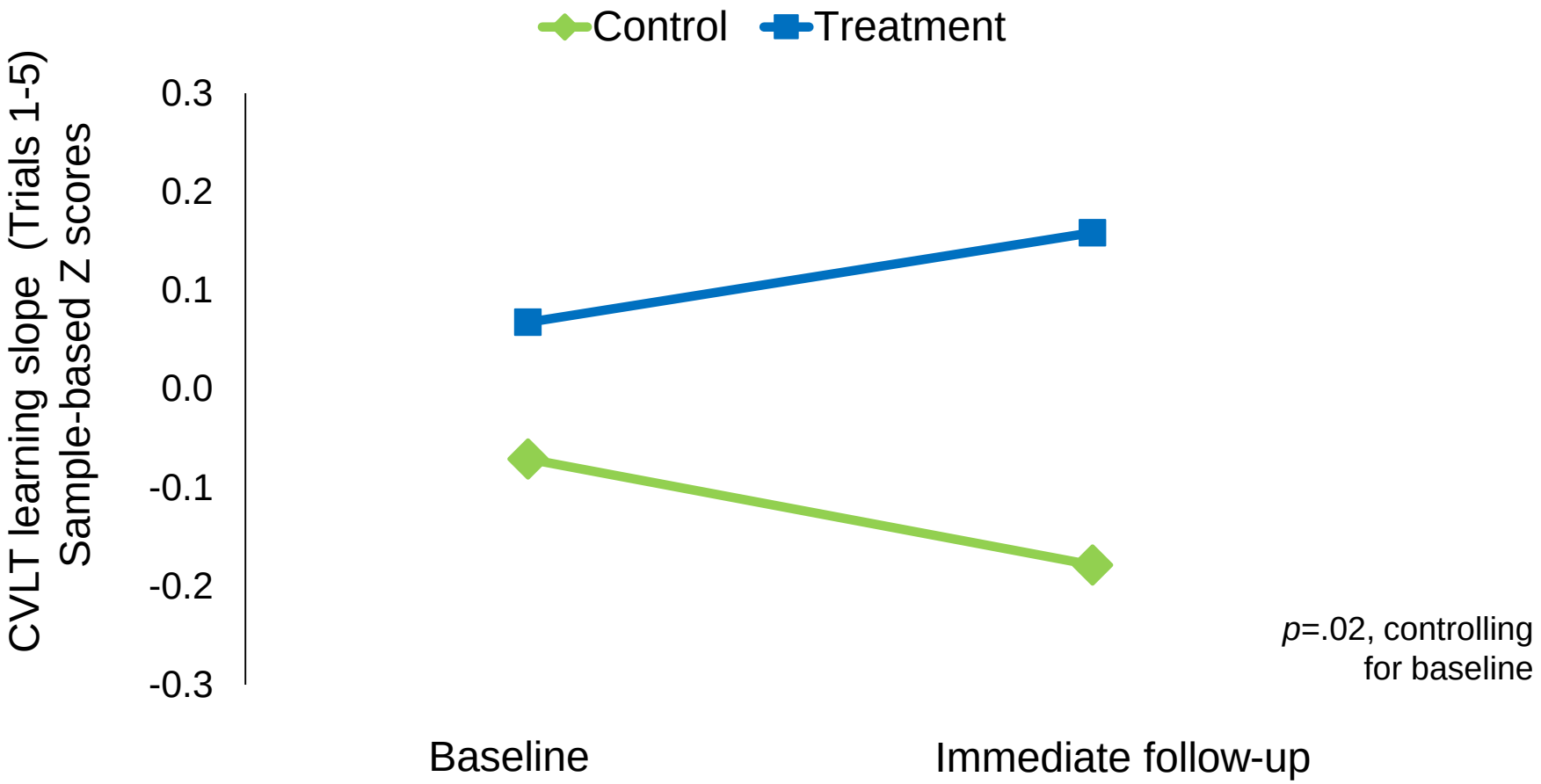
- Uses **imagery** and **context** to facilitate learning
  - Dosage: 10 sessions
    - 2x per week for 5 weeks
    - 30-90 minutes in duration
  - Treatment content:
    - Weeks 1-4: Imagery
    - Weeks 5-8: Context
    - Weeks 9-10: Generalization

Studies on the mSMT

- MS
- Multiple Sclerosis and Related Disorders, *7*, 76-82; 2016.
- Multiple Sclerosis Journal, 21(12), 1575-1582; 2015.
- Brain imaging and behavior, 8(3), 403-406. 2014.
- Brain imaging and behavior, 8(3), 394-402. 2014.
- Neurology. 10;81(24):2066-72; 2013
- Journal of Neurology, 259(7), 1337-1346; 2012

- TBI
- Archives of Physical Medicine and Rehabilitation, 97(6), 1026-9; 2016.
- Neurorehabilitation and Neural Repair, 30(6), 539-550; 2016.
- The Journal of Head Trauma Rehabilitation, 30(4), 261-269; 2015.

Learning Performance by Group



p=.02, controlling for baseline

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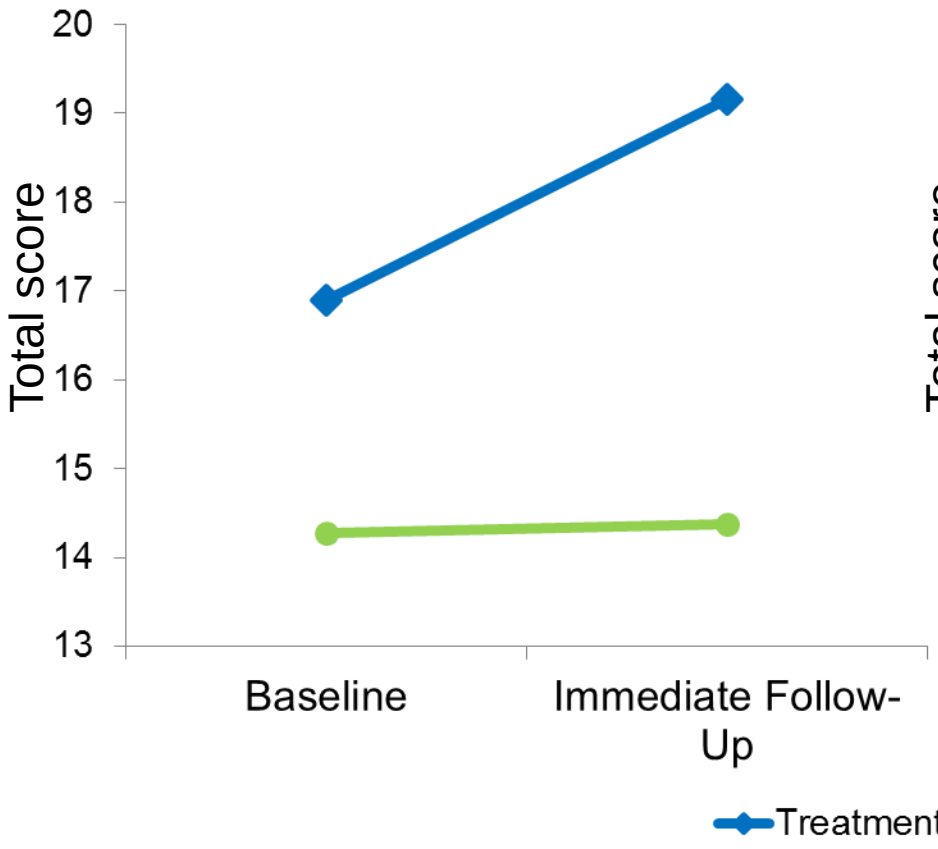
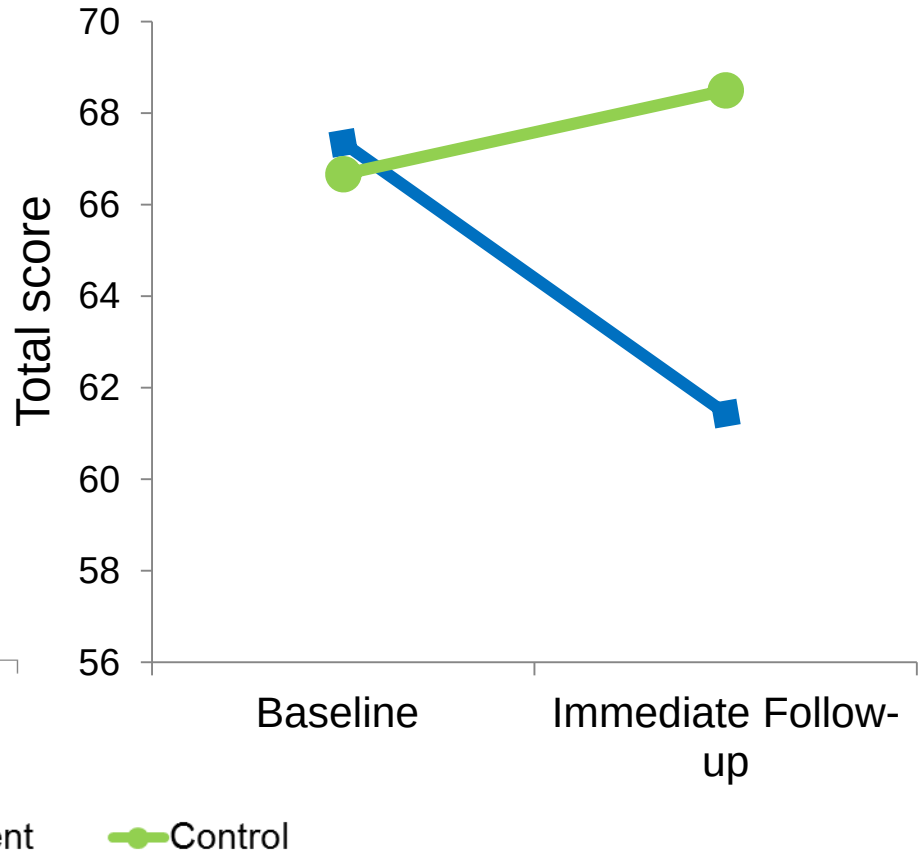
Chiaravalloti et al. (2013) *Neurology*

Everyday Life Self-Report

FAMS General Contentment



FrSBe Total Score, Family Form



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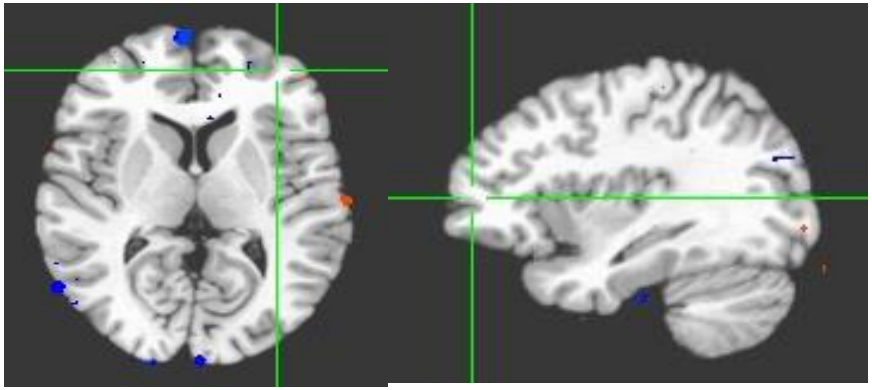
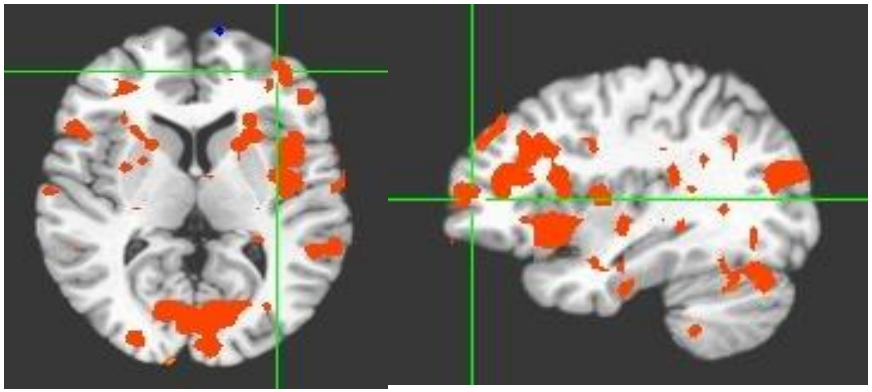
Chiaravalloti et al. (2013) *Neurology*

Changes in Brain Functioning in MS



- Pre-training
  - Treatment minus control



- Post-training
  - Treatment minus control

Increased activation in frontal and occipital regions in treatment group that is not evident prior to treatment (p<.05)

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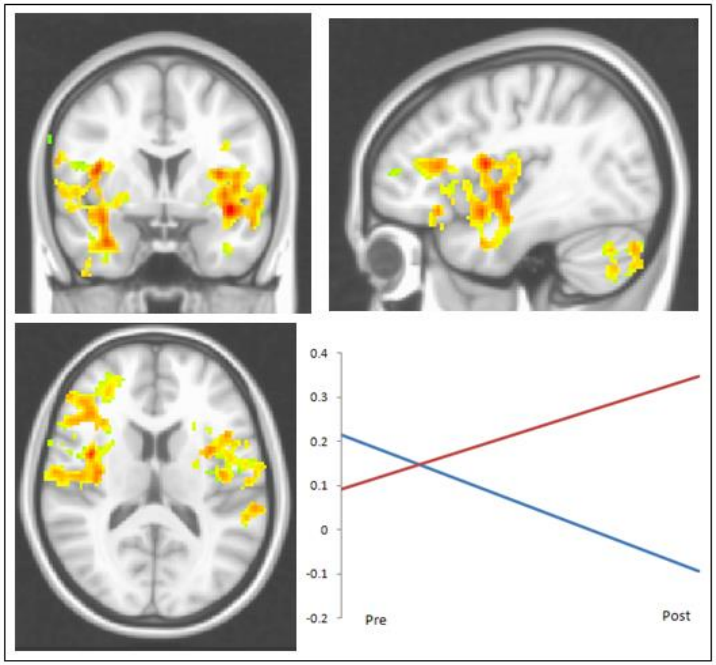
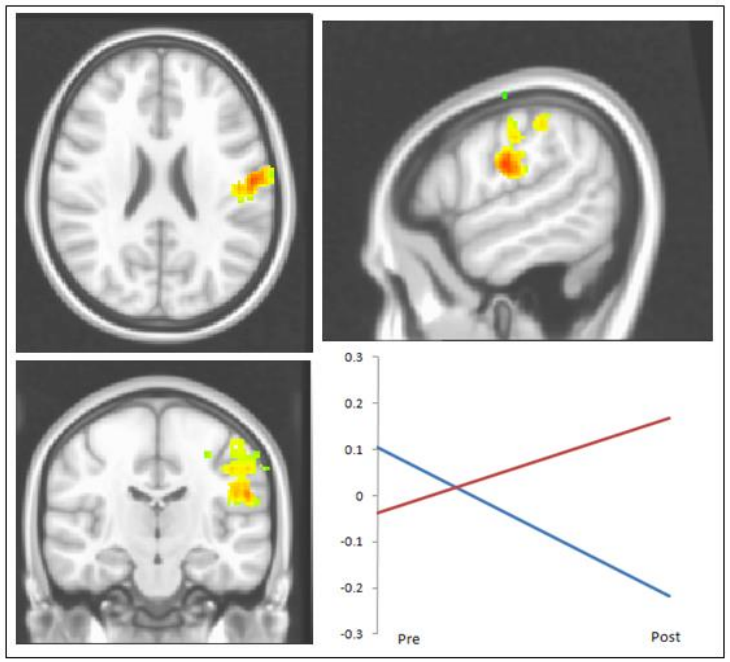
Chiaravalloti et al. (2012) *Journal of Neurology*

Functional Connectivity



Increased connectivity post-tx in mSMT group from left hippocampus to:
-left and right insulae



Increased connectivity post-tx in mSMT group from right hippocampus to:
-left post-central gyrus
-precentral gyrus
-middle frontal gyrus
-cingulate gyrus

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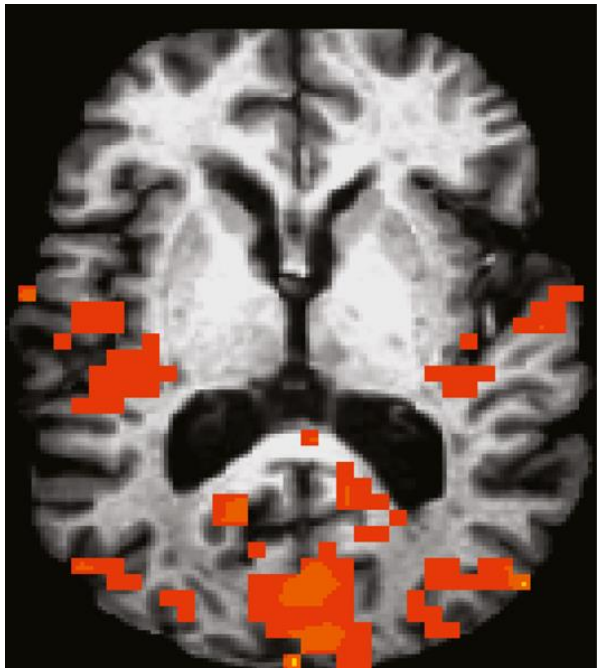
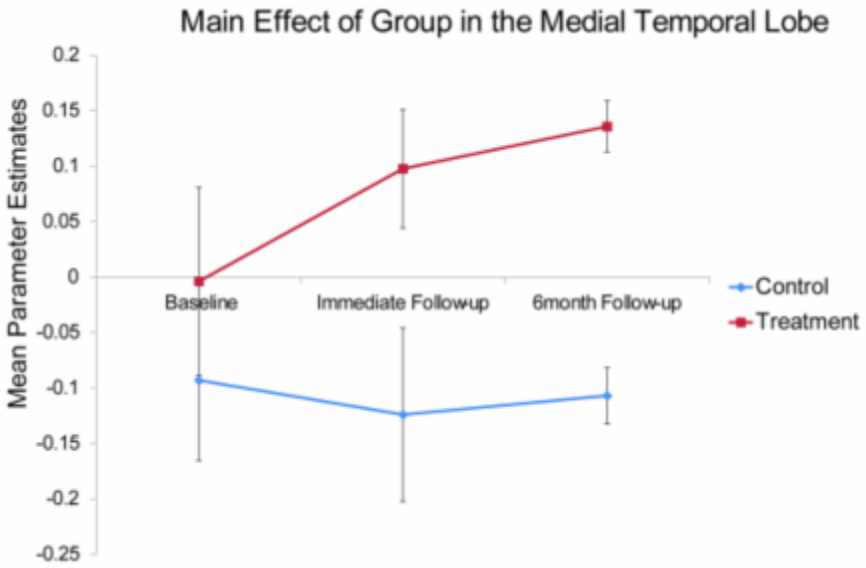
Leavitt et al. (2013) *Brain Imaging and Behavior*

Long-term effects of mSMT





Brain regions showing significantly greater activation in the treatment group vs placebo control group across the immediate and long-term follow-up

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Dobryakova et al. (2014) *Brain Imaging and Behavior*

Treatment Protocol 2

New Learning & Memory

Stylistic Memory Enhancement

Repetition Effect

- Information that is repeated will be remembered better than information presented only once

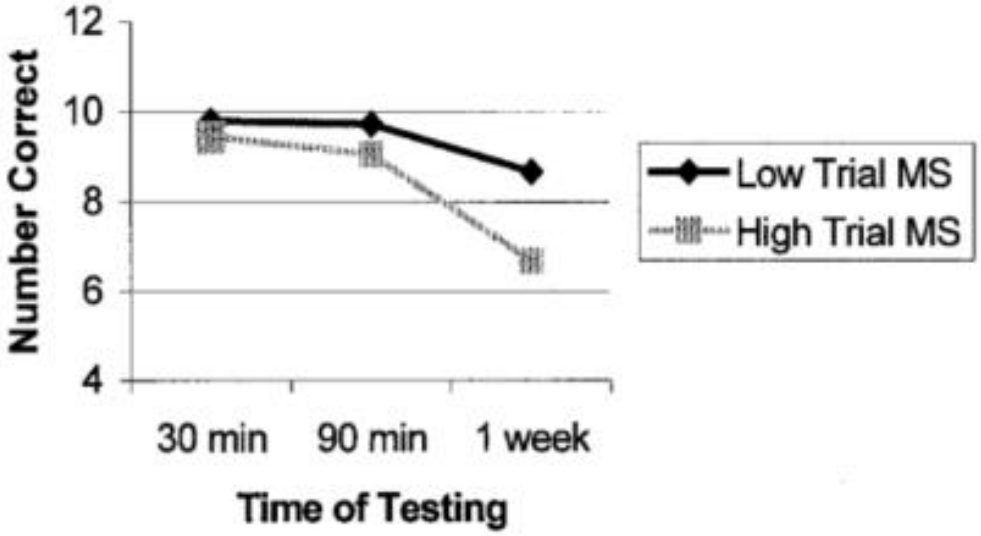


Figure 1 Number of stimuli recalled by group and delay for the MS subjects.

Chiaravalloti et al. (2003) *Clinical Rehabilitation*

Lessons from Cognitive Psychology

- Various techniques exist to improve memory, but have largely been tested in healthy young adults (college students)

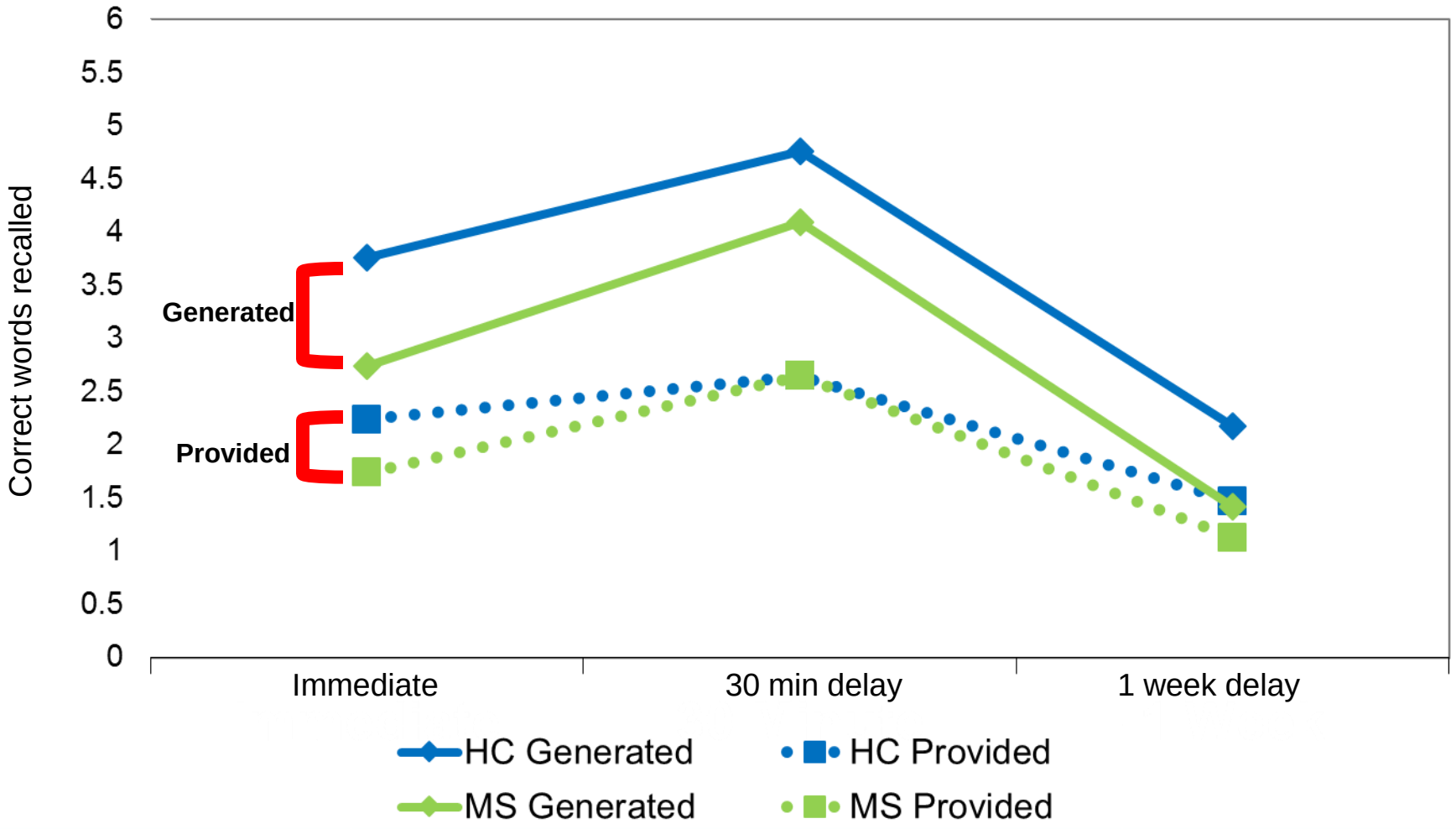
- Specific areas of investigation
  - Generation effect (Chiaravalloti & DeLuca, 2002)
  - Spacing effect (Goverover et al., 2009)
  - Testing effect (Sumowski et al., 2010)

Generation Effect

- Information that an individual generates on his or her own will be remembered better than information that is provided to them

  - "Today's talk is on memory rehabilitation of multiple **s**_____."
  - "I need to make sure I'm finished by **(1+1=__)** o'clock."

The Influence of Self Generation



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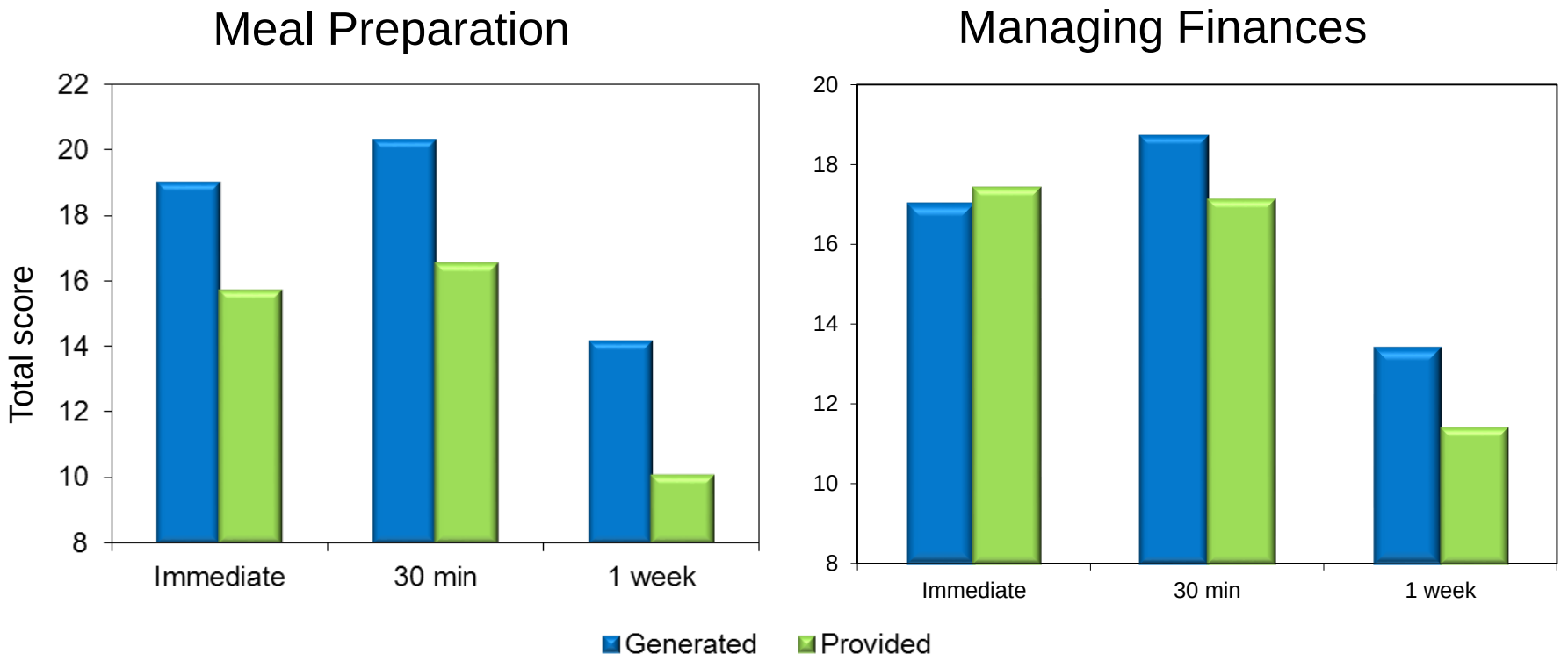
Chiaravalloti & DeLuca (2002)
Archives of Physical Medicine & Rehabilitation

Self-Generation and Everyday Life Activities



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Goverover et al. (2008)
Archives of Physical Medicine & Rehabilitation

Spacing Effect

New learning in healthy individuals is significantly improved when trials:

- Are **SPACED** or distributed over time

compared to

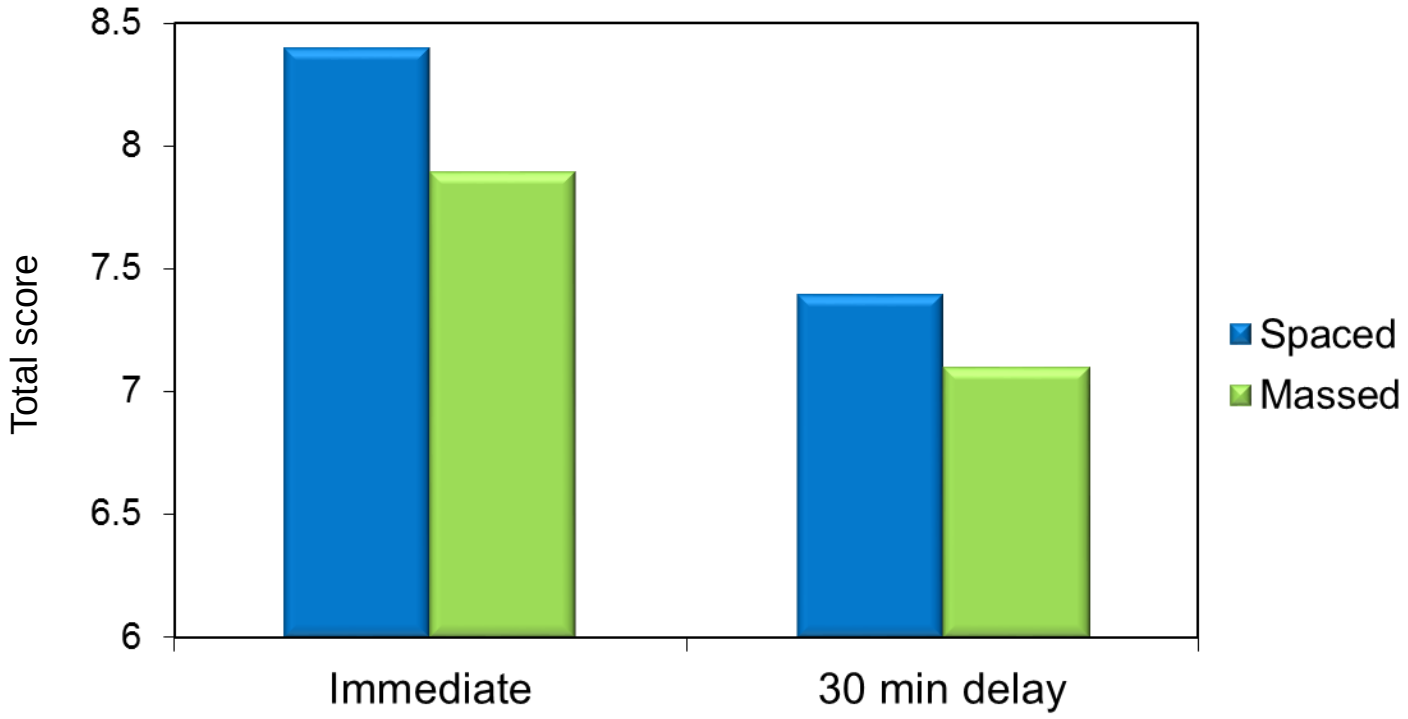
- **MASSED** or consecutive learning trials

Ebbinghaus, 1885/1994

Spaced Learning or “Spacing Effect”

- Instructions on how to perform tasks were presented three times in two conditions:
  - Massed condition 1/2/3
  - Spaced condition 1_____2_____3
  - Within-group design

Spacing Effect – Newspaper Paragraph



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Goverover et al. (2009) *JCEN*

Research Paper

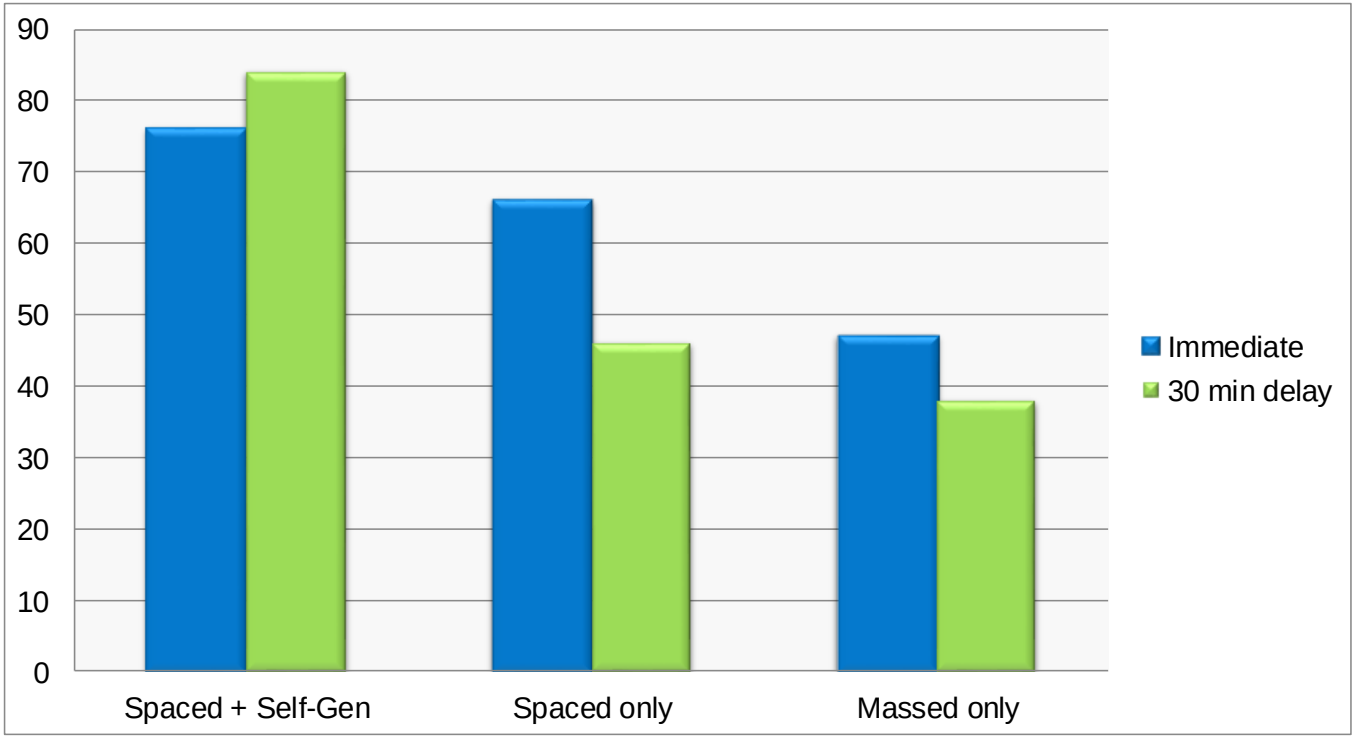
MULTIPLE SCLEROSIS JOURNAL | MSJ

Multiple Sclerosis Journal
17(12) 1488–1497

DOI: 10.1177/1352458511406310
msj.sagepub.com
SAGE

Examining the benefits of combining two learning strategies on recall of functional information in persons with multiple sclerosis

Yael Goverover[1,2], Michael Basso[3], Hali Wood[2], Nancy Chiaravalloti[2,4] and John DeLuca[2,4]



Testing Effect

- Information that is tested periodically is better remembered than information that is repeatedly provided to a person for later memory

Testing Effect in Healthy Young Adults – Textbook Reading

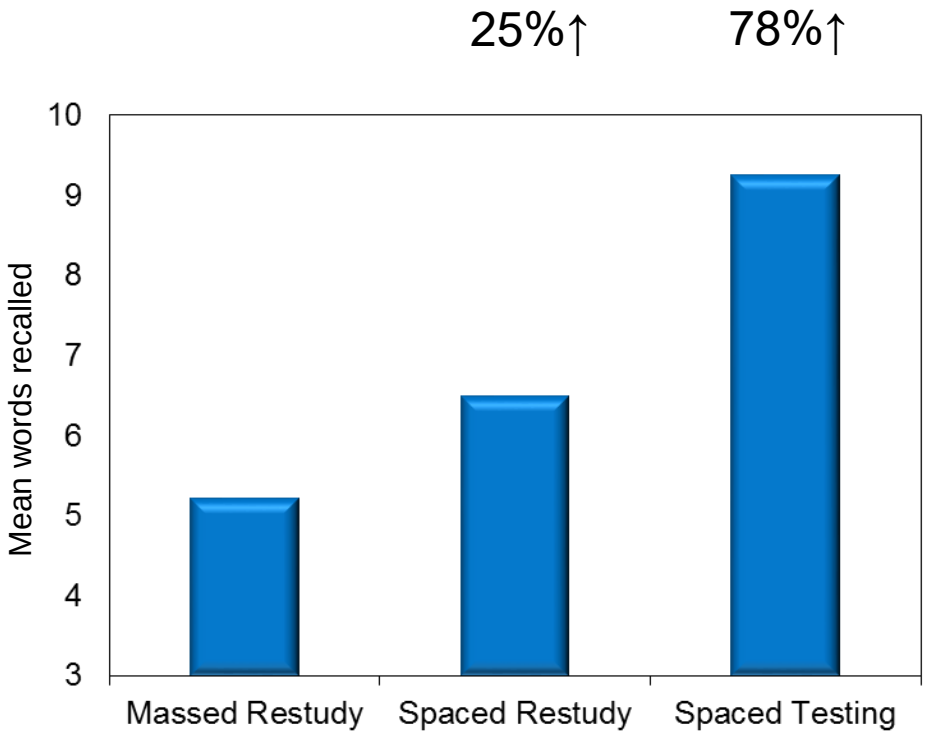
SSSS – study 4 times

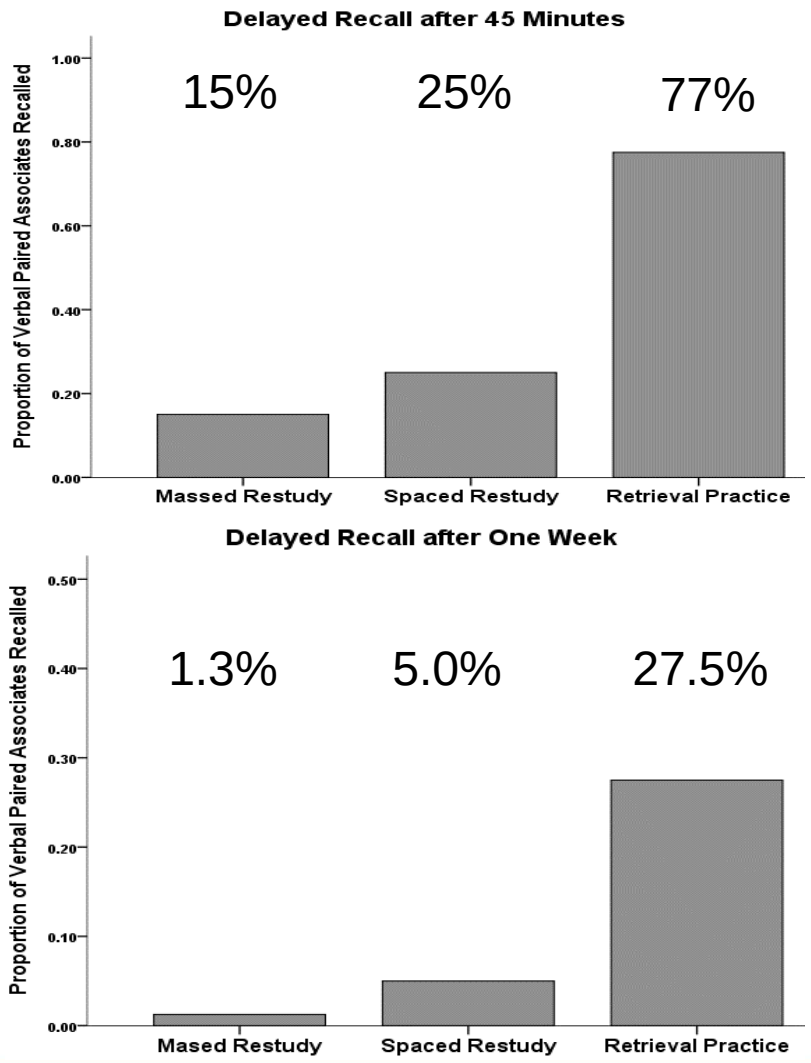
SSSR – study 3 times then recall once

SRRR – study 1 time then recall 3 times

Karpicke (2012) *Psychological Science*

Testing Effect in MS





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Sumowski et al. (2010) *Neuropsychology*
Sumowski et al. (2013) *MSJ*

Stylistic Memory Enhancement

- Teaches participants how to apply novel techniques to improve memory in daily life

- Teaching application of:
  - Generation effect
  - Spacing effect
  - Testing effect

- 8 session treatment protocol for:
  - Persons with MS
  - Significant Other

Stylistic Memory Enhancement

- Strong initial data in MS
- Strong pilot data in TBI
- Large RCTs currently proposed

Funding Sources