The Limitations of Retrieval Practice for Comprehension

Tricia A. Guerrero, Thomas D. Griffin, & Jennifer Wiley
University of Illinois at Chicago

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Background

Retrieval Practice (RP)
- Strengthens memory traces
- Produces robust effects on memory for information (Roediger & Karpicke, 2006)

Does retrieval practice improve learning from grade-level appropriate, complex expository texts?

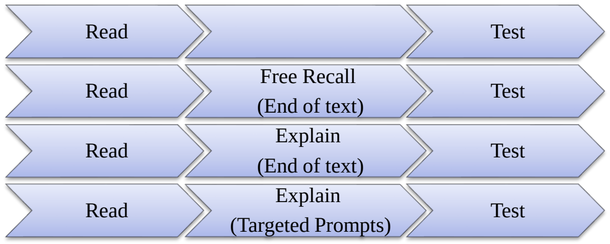
- Does RP improve memory for text?
  →Text-based Questions
- Does RP improve comprehension of text?
  →Inference Questions

(Kintsch, 1994; Mayer, 1989; Griffin, Wiley, & Thiede, 2018)

Are more constructive activities needed to improve comprehension outcomes?
(Hinze, Wiley, & Pellegrino, 2013)

Method

96 participants, 2 texts, 10 questions each
Observations for LME: 1920



Free Recall:
"Recall as much of the exact text as you can. If you cannot remember the exact words of a sentence, it is acceptable to write down whatever you can recall."

Explanation: (Hinze, Wiley, & Pellegrino, 2013)
"How does this information help you to understand…how volcanic eruptions occur?"

Targeted Explanations: (Magliano & Millis, 2003)
How does this information help you to understand…?"
Placed after 5 key sentences

Complex Expository Science Texts

~1,000 words
~11th grade level
Describe a system or process (Griffin, Wiley, & Thiede, 2018)

Text Excerpt: Ice Ages

The more CO2 there is in the atmosphere, the more long-wave radiation is kept from leaving the Earth. The more radiation that is trapped, the hotter the Earth becomes. This trapping of radiation works like a gardener's greenhouse, and this phenomenon is commonly known as the 'Greenhouse Effect'. When a region receives less solar radiation, there is less energy to warm that area. Less heat energy leads to cooler temperatures. Cooler temperatures can cause more snow and ice to form. Snow and ice can reflect what little solar energy reaches the surface of the Earth back into space...

What is the greenhouse effect?
-The absorption of CO2 by growing plants
-The trapping of radiation
-The increase in heat of the earth due to sunspots
-The increase in burning of fossil fuels

Higher levels of CO2 in the atmosphere lead to…
-higher sea levels
-the creation of mountain ranges
-the formation of more ice and snow
-changes in the Earth's surface

5 Text-Based Questions per Text

-Question stem and answer are found within a single sentence
-Answer can be found through lexical search methods

5 Inference Questions per Text

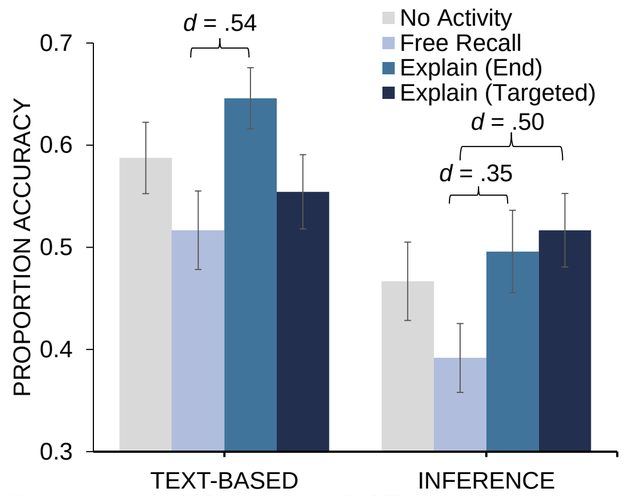
-Answer requires making connections across multiple sentences
-Requires generation of implicit causal relationships

Quality of Response Coding

Reproductive	Constructive
(κ = .80)	
Ice ages occur because temperatures change. The water levels are low and the temperature in the air is cold. The earth is cold for a period of time and then warm for a period of time.	A warming period happens because of CO_2 gases being produced and when there are more CO_2 gases, radiation is trapped in the atmosphere, making the earth hotter.

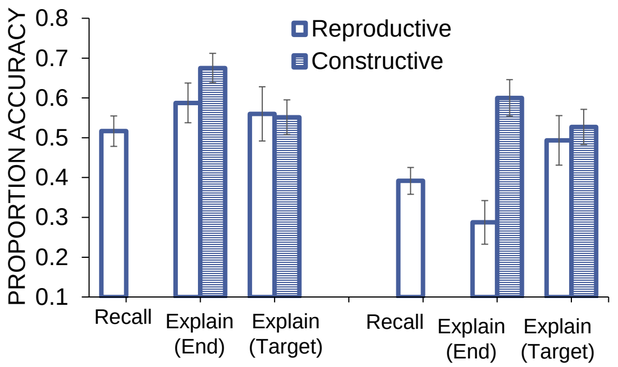
Frequency		
	Reproductive	Constructive
Free Recall	100%	0%
Explain (End)	33%	67%
Explain (Targeted)	31%	69%

Results



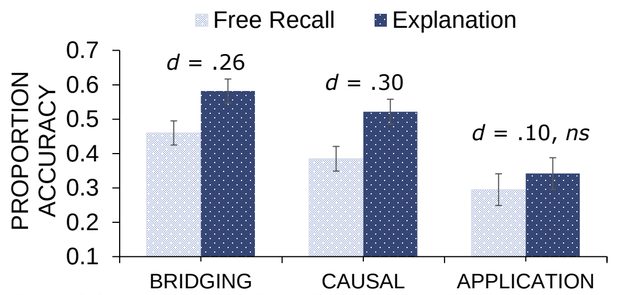
Text-based: $F(3,1912) = 2.95, p = .03$
Inference: $F(3,1912) = 2.62, p = .05$

PERFORMANCE BY QUALITY OF RESPONSE



Interaction(Condition x Response Quality)
Text-based: $F(1,476) = .85, p = .36$
Inference: $F(1,476) = 7.76, p < .01$

PERFORMANCE BY INFERENCE TYPE



Condition: $F(1,714) = 5.72, p = .02$
Inference Type: $F(2,714) = 8.06, p < .001$

Conclusions

On grade-level-appropriate expository science texts, retrieval practice did not improve either:
- Memory for text
- Comprehension of text

Recall activities may focus readers on the surface level at the expense of understanding.

Generating a single explanation after reading improved memory for information, while responding to targeted prompts better supported comprehension outcomes.
- General prompts aided comprehension if students engaged in constructive processing.
- Targeted prompts highlight key causal concepts which may help those not engaging in constructive processing.

Striking difficulty and lack of improvement in answering application questions
- More work is needed to explore what conditions can improve performance on these question types, and to understand the reasons for differences among the inference question types.

References

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