Retrieval Practice: The roads between research and practice

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A Journey from Neuroscience to the Classroom

**Retrieval Practice**

- Neuroscience of Retrieval
- Cognitive Science: Retrieval Practice
- Guidelines for application
- Barriers for Students and for Teachers
- Reasons, Solutions?
- Education – Research Communication

*Images: pixabay*
What does the brain do?
Interacting with the Environment

- Senses
- Motion
- Long Term Memory
Neural Representations

Senses

Motion

Long Term Memory

?
Neuroscience of Retrieval

- **Encoding**
- **Consolidation**
- **Storage**
- **Retrieval**

- **New concept**
- **Existing concepts**
- **Inactive**

*plasticity*
Understanding Retrieval

Encoding
Active

Consolidation
Building connections

Storage
Inactive

Based on: Nader and Hardt,
Nature Reviews Neuroscience, 2009
Based on: Nader and Hardt,
Nature Reviews Neuroscience, 2009
Reconsolidation in Human Memory

Hupbach, Gomez, Hardt, Nadel, Learning & Memory, 2007
Reconsolidation in Human Memory

List A

Monday

List B

Wednesday

List A - TEST

Friday

Hupbach, Gomez, Hardt, Nadel, Learning & Memory, 2007
Activation → Malleability → Long-Term modification

- Erasing Memories
  - Animal models
  - Future: trauma, phobia

- Updating Memories
  - Eyewitness testimony
  - Memory Illusions

- Enhancing Memory
  - Cognitive Psychology
Cognitive Science of Retrieval Practice

Karpicke & Roediger, Science 2008:

Experiment: 40 students learned 40 words in a new language (Swahili)

- Study (S)
- Test (T)

MASHUA - Boat
MASHUA

Learning Phase

S T S T S T S T
Experimental Design

4 Experimental Groups

A  B  C  D

# Practice trials

1 week

40 Words
MASHUA - ?

TEST

Karpicke & Roediger, Science 2008
Results

Karpicke & Roediger,
Science 2008
More Information

THE LEARNING SCIENTISTS
www.learningscientists.org

Retrieval Practice
www.retrievalpractice.org

Make it stick
www.makeitsick.org
Retrieval (or Testing) is a highly effective practice strategy.
Conclusions

Long – Term Memory Store
Conclusions
Conclusions
Critical Points

✅ **Active** in students minds

✅ Retrieval **Practice follows** initial learning

✅ **Post-retrieval** experience – feedback, making new connections

✅ **Long-term** effect – effective when **effortful** Spacing, Varying,
How come not Everybody uses Retrieval Practice all the time ?!?
What are the barriers?

Learners fail to predict their long-term learning outcomes
3 groups learning texts by Studying or by Testing

Memory Tests

Roediger and Karpicke, 2006
Retrieval Practice Works?

Memory Tests

Roediger and Karpicke, 2006
Retrieval Practice Works?

Memory Test

Predictions
(1-7 scale)

Roediger and Karpicke, 2006
Retrieval Practice Works?

Retrieval is Effective in the Long-Term

Memory Tests

Predictions (1-7 scale)

Roediger and Karpicke, 2006
Different mechanisms of memory:
The Paradox

Short-Term

Restudy

Retrieval Practice

Long-Term

Desirable Difficulty

(Bjork, 1994)
Re-Read and Succeed

Color code: Learning, Testing, Motivation
Cognitive vs. Emotional

Short-Term

Long-Term

Difficult (Emotional)

Desirable (Cognitive)
TEACHERS

RETRIEVAL PRACTICE as a ROUTINE
Retrieval FOR Learning

Learning time

Learn to the test
Test to learn

Color code: Learning  Testing  Motivation
Retrieval FOR Learning

Color code:  
- Learning
- Testing
- Motivation

ALL THE STUDENTS  
ALL THE TIME  
Closing Gaps (?)
Barriers for Teachers

My Experience (based on survey):

1. Teachers understand and appreciate the benefits of retrieval practice for students.

2. Identify many barriers:
   TIME, lack of support, incompatible “system”

3. They ask for support
   Discipline Specific PD, available materials, professional support
What is your experience?
Barriers for Teachers

Short-Term

- Difficult
- Desirable

Long-Term

- Difficult
- Desirable
What can we do?

Developing a community and culture of Bridging research and education.

Cognitive research in schools

Goal #1: Inform, engage, experience

Ben Hur, Bueno, Reisner, Somer & Weinberg 2011

Karpicke & Roediger Science 2008
The present and the future

Research
- Field-inspired research questions
- Information
- Teaching
- desirable

Communication
- Publishing observation and conclusions
- difficulties

Education
- Implementation
- Field – research
- Evaluation
Sample questions – Practice Retrieval
Share your experience
Learn more

https://goo.gl/forms/d8YP7Hj4LGjrBBnI3