CENTER FOR ADVANCED STUDY OF LANGUAGE

Leveraging the science of learning for language training

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Science of learning for language training

Cognitive science of learning:
> 50 years

Application to language learning: under-utilized

Insertion in human- and computer-delivered training: just beginning

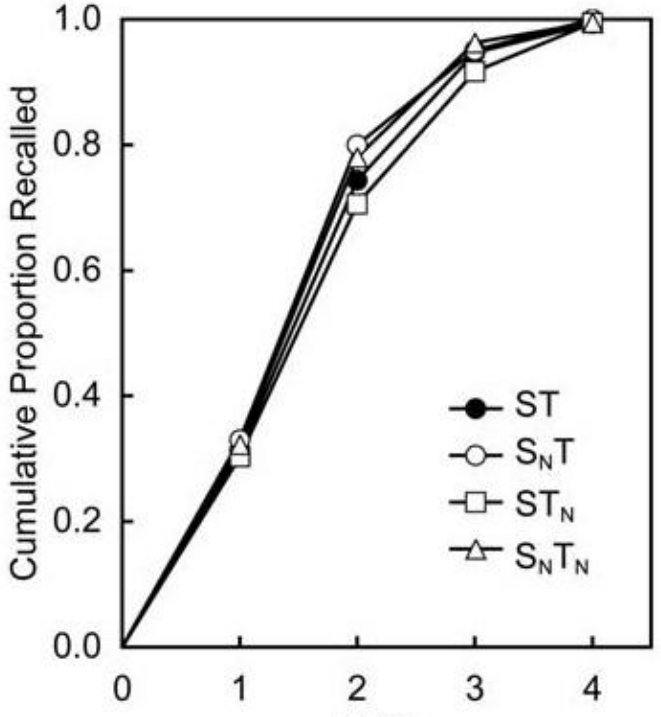
Test your learning knowledge

- **Imagine:**
  - You are given 40 word pairs, such as these Swahili-English pairs:
    - *Fununu - Rumor,*
    - *Mashua - Boat,*
    - *Tabibu - Doctor*
  - You have to study the entire list repeatedly, alternating between **study practice** and **self-evaluation** practice.
  - **Study practice** involves looking at the two words and associating them in your mind
  - **Self-evaluation practice** involves covering up the English word, and generating it from memory, given the Swahili word.
  - You are given 40 minutes to accomplish this task

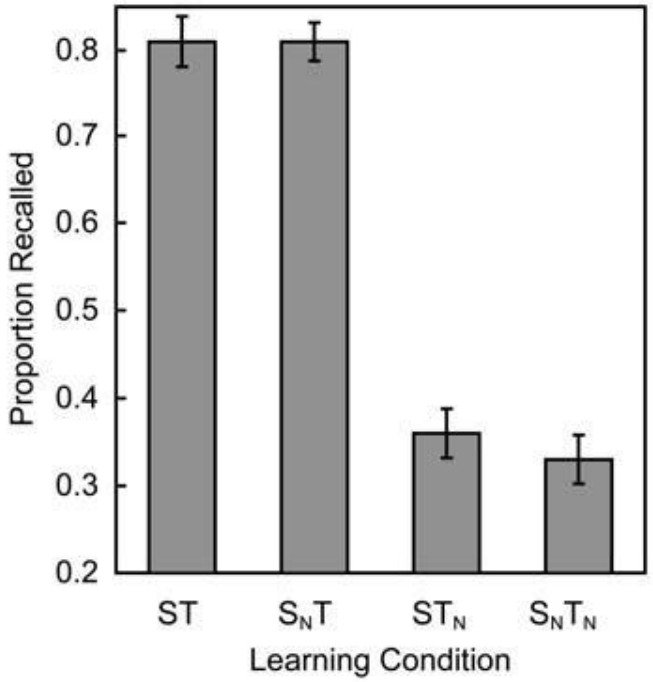
How would you study to enhance your **long-term** retention of the words? Please, do not share your answers out loud.

1) I would engage in **(a)** more **study** practice than **self-evaluation** practice or **(b)** more **self-evaluation** practice than **study** practice.
2) During **study practice,** I would **(a)** put aside words that I can already recall correctly and focus my study on the words that I cannot yet recall correctly or **(b)** continue to practice all words, whether I can correctly recall them or not.
3) Same question as 2, but now for **self-evaluation practice**.
4) If error **feedback** were **not available**, engaging in self-evaluation practice is something **(a)** I would do or **(b)** I would **not do.**
5) In between repetitions of a list of words, (a) I would or **(b)** I would not engage in an unrelated activity (e.g., take a minute or two to look at my email).

Testing improves long-term but not short-term retention (Karpicke & Roediger, 2010): Testing effect



Short-term retention (initial learning)

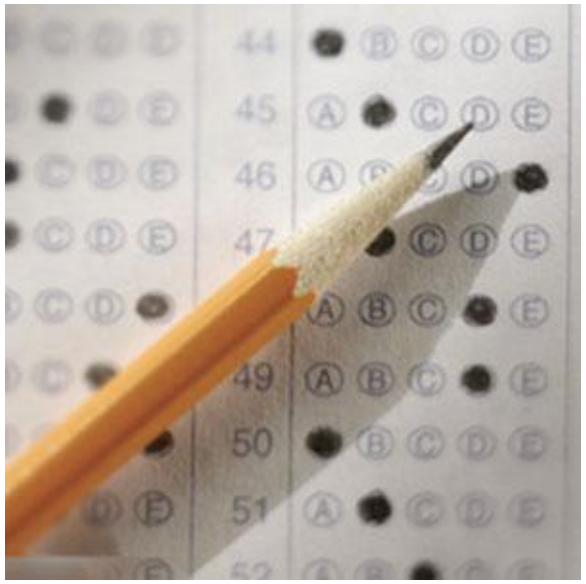


Long-term retention (after 1 week)

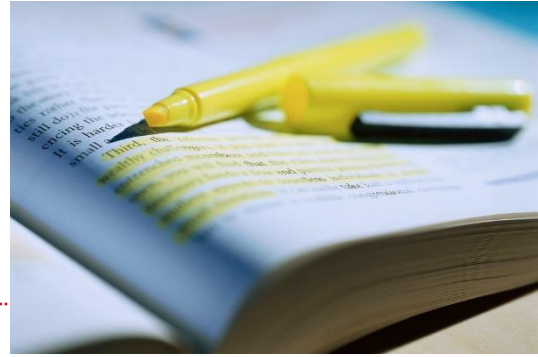
Also (not shown): no differences among participants in how well they predicted long-term recall (50%)

Testing effect is well established

- **Materials**
  - Single words, foreign language word pairs, essay texts, studied facts, face-name pairs, maps
- **Feedback**
  - With and without feedback
- **Memory tasks & types**
  - Cued recall, free recall, mpc
  - Declarative, procedural memory
- **Populations:**
  - Children, young & older adults
- **Context**
  - Controlled laboratory studies
  - Educational context
- **Outperforming** encoding strategy of elaboration



Learning strategies



Strategy	Utility	Use
Practice testing	High	Under-utilized
Distributed practice	High	Under-utilized
Elaborative interrogation	Moderate	
Self-explanation	Moderate	
Highlighting / underlining text	Low	Over-utilized
Re-reading text	Low	Over-utilized
Imagery use for text-based learning	Low	
Key-word mnemonic	Low	
Practicing long-term memory as a muscle (e.g., poetry)	None	Still used

Source: Roediger (2013, In Psychological Science in the Public Interest).

Explanation for underutilization – part 1: trade-off between learning techniques

Good long-term retention	Depth of expertise
Rapid performance gains	Easy access in working memory

Explanation for underutilization – part 1: trade-off between learning techniques

		Practice testing	Practice schedule	Context	Elabo-ration
Good long-term retention	Depth of expertise	Test > Study	Spaced	Variable	Extensive
Rapid performance gains	Easy access in working memory	Study > Test	Massed	Constant	Minimal

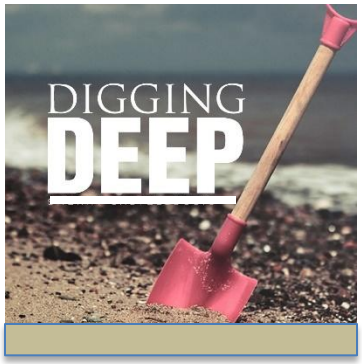
Explanation for underutilization – part 1: solving the trade-off

		Learning phase
Good long-term retention	Depth of expertise	Later
Rapid performance gains	Easy access in working memory	Early

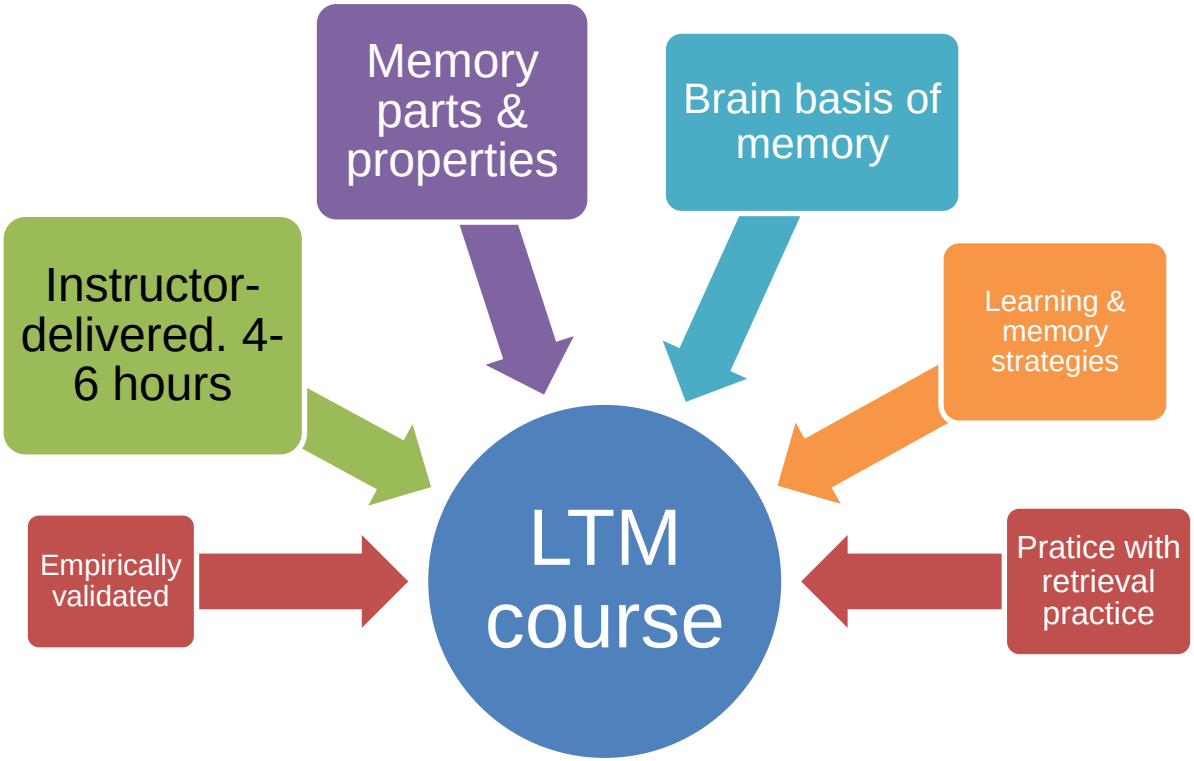
Explanation for underutilization – part 2: counter-intuitive memory mechanisms

- Does it help to learn additional content that is not on the test?
- Is a learner who experiences memory retrieval difficulties on the right path?
- Am I not the best judge / experiencer of my own performance gains?

	short-term & shallow	x
x	long-term & deep	



CASL Long-term memory course for government employees

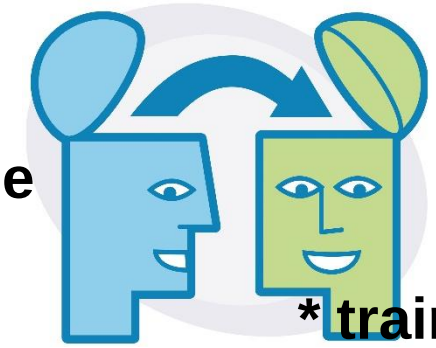


Delivered to various USG government departments and agencies

Infusion model 1: knowledge transfer

CASL

1st) Instructor-Delivered course



US Government

*** instructional designers**

*** training managers**

*** student counselors**

*** trainers of teachers**

2nd) Train-the trainer(s) → *** teachers**

Infusion model 2: knowledge exchange (FSI, 2014, CASL with Caplan & Gilzow)

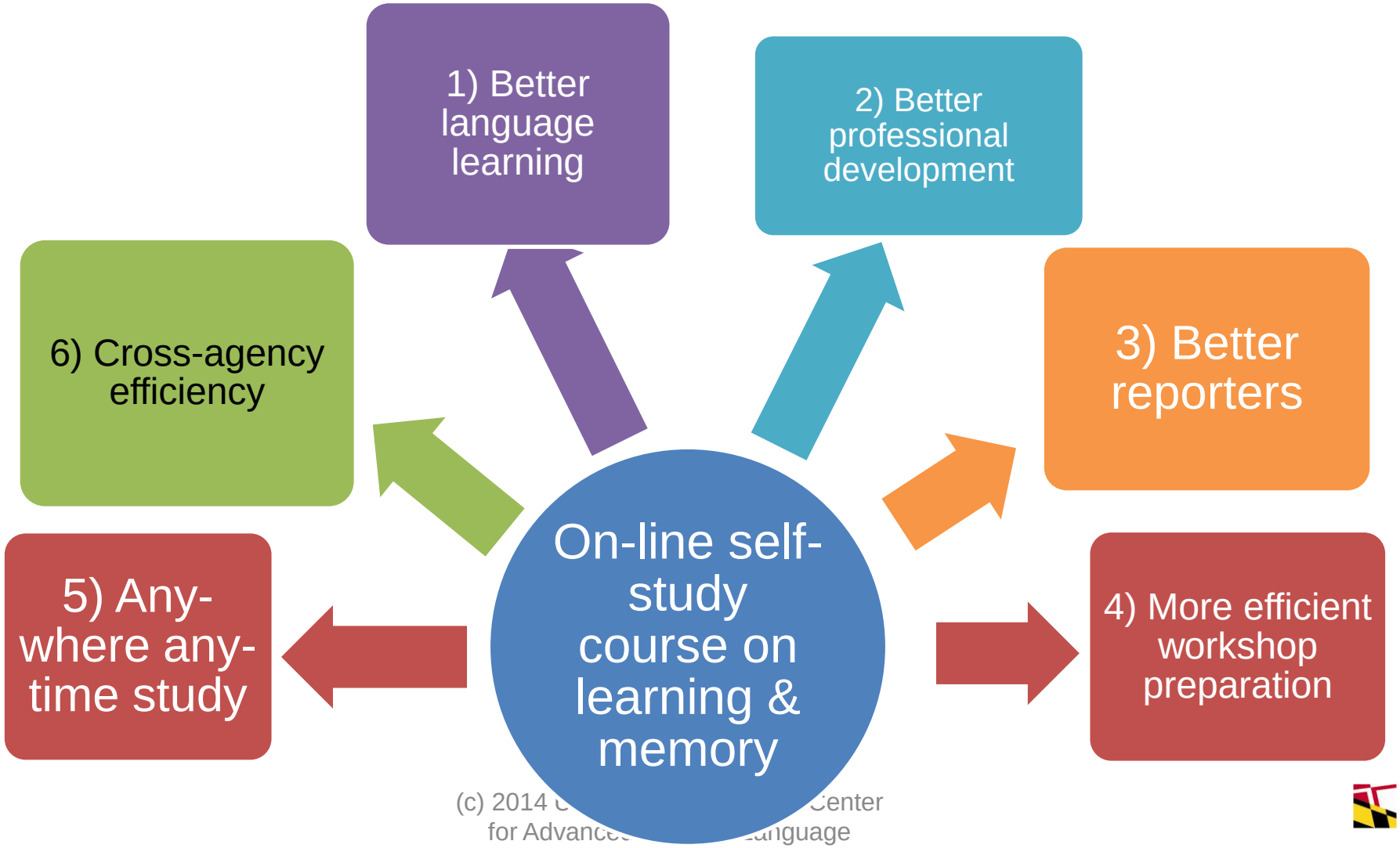
1st) CASL-Instructor-delivered course

USG language training experts

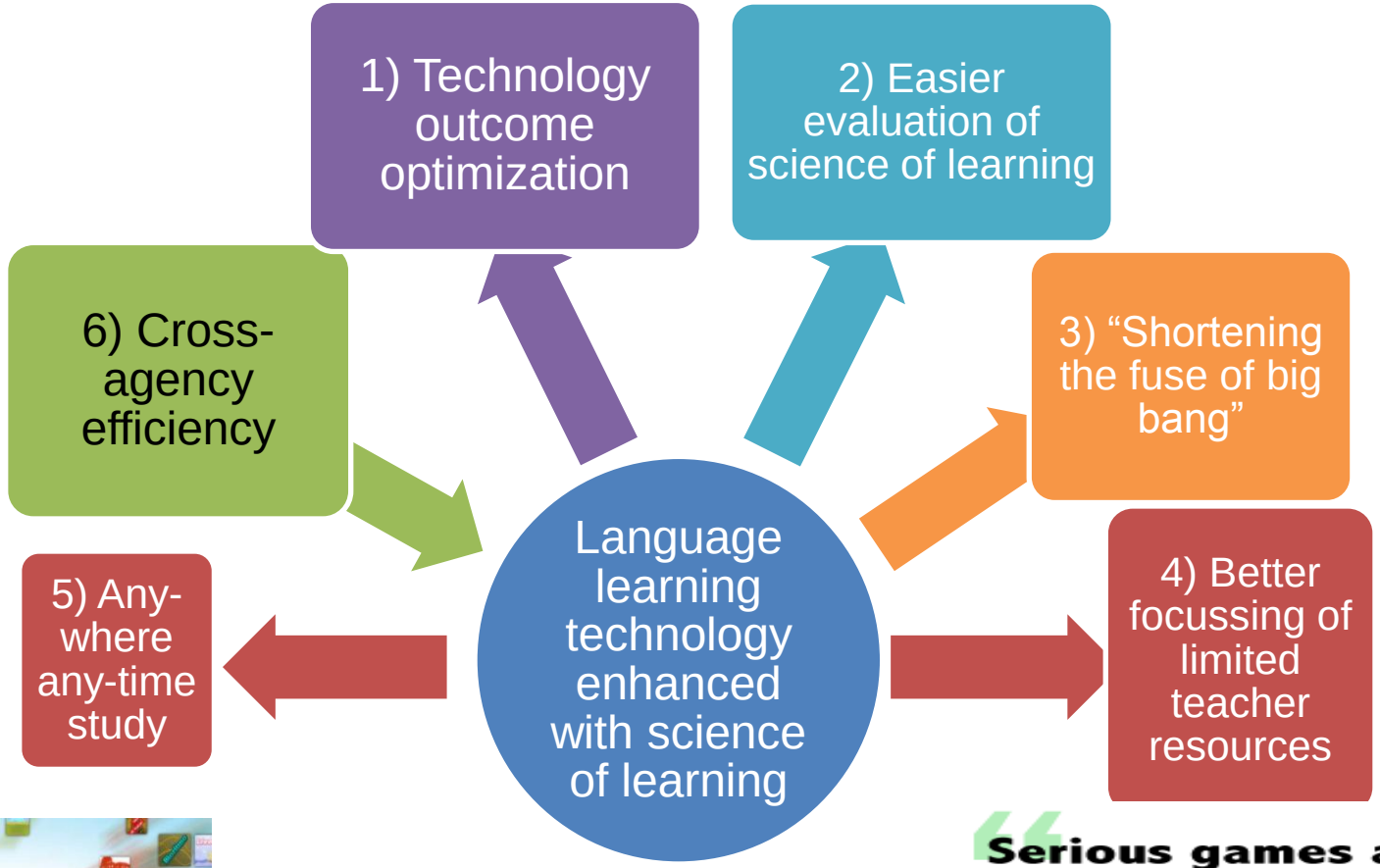
2nd) CASL-facilitated workshop series

* Refresh course content
- Select learning principles
- Form project groups
- Work out project group plans
- Report out concrete products (student counselors' handout, teacher brown bag, video clip, classroom activities)

“Many-for-one” recommendation #1



“Many-for-one” recommendation #2



“Serious games are MORE THAN FUN.”

Scientific technical aspects of language training evaluation study

- Random sample of participants from large population
- Random assignment of participants to a training and control condition
- Teaching system and students blind to condition
- Controlled timing of assessments

  E.g.,
  pre-test & post-test: 1 week between immediate and delayed recall

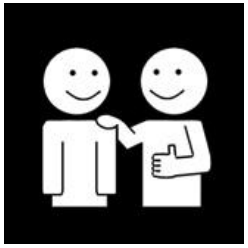
- Rich assessments

  E.g.,
  log data, accuracy, RT, attention/effort (pupillometry)

easier to implement in online, self-study than in classroom study

Leveraging the science of learning for language learning: conclusions

Government language training professionals should

- take an **on-line course** on learning and memory
- apply the resulting knowledge in **workshops** aimed at improving concrete language learning products
- pay special attention to powerful **under-utilized learning principles**, such as, practice testing and distributed practice
- partner with industry and academe to create and improve **cognitively enhanced language technology**
- and to explore potential big-bang approaches, such as
  - **implicit learning**
  - **working memory training**
  - **adaptive learning**
-  give themselves a pat on the back for **promoting global peace and prosperity** through better communication

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