

# Notes-taking as a cognitive activity

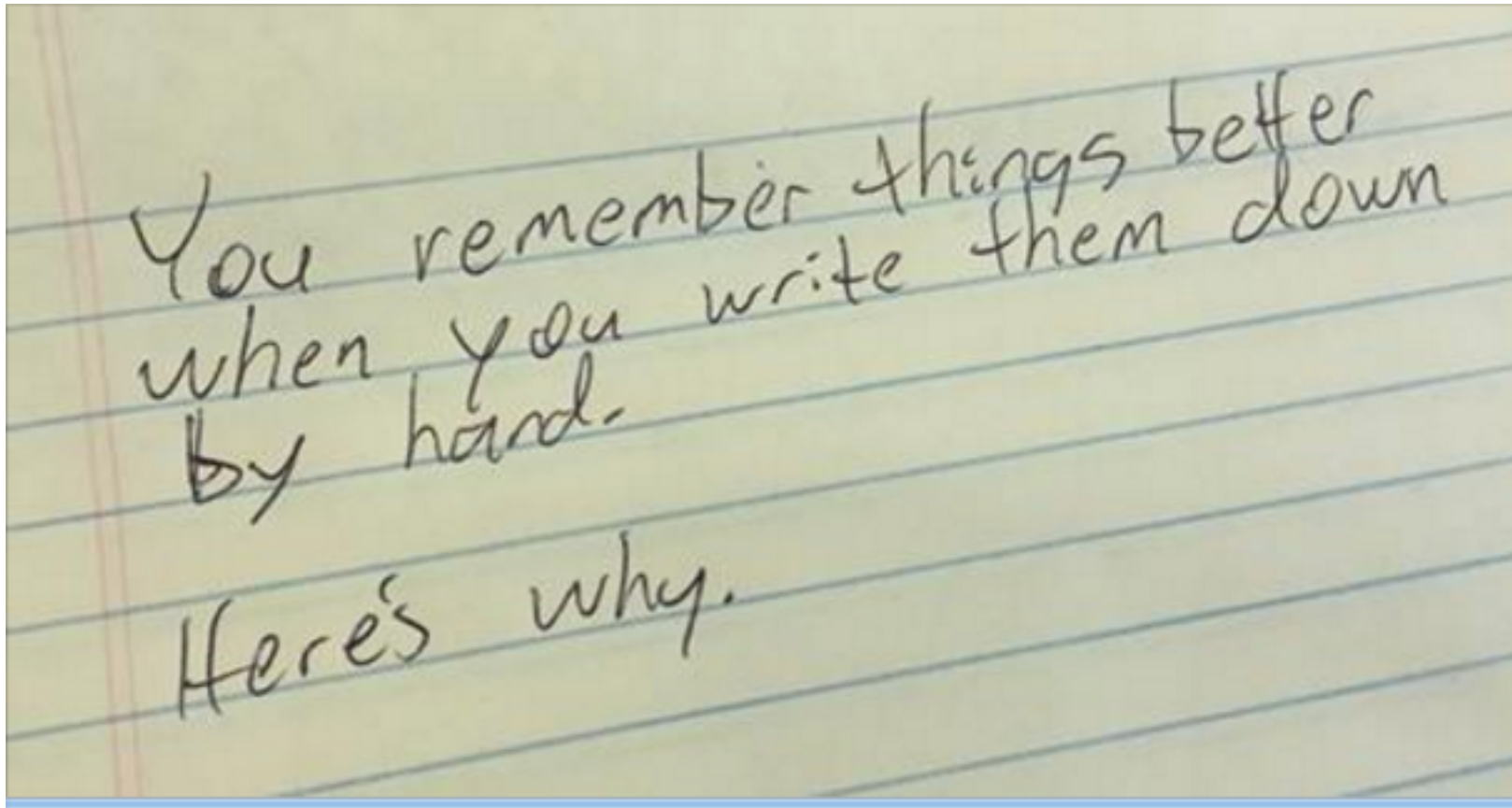
(thanks to Prof. Antonella De Angeli)

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The Pen Is Mightier Than the Keyboard:  
Advantages of Longhand Over Laptop Note  
Taking

Psychological Science 2014, Vol. 25(6) 1159–  
1168

# Notes taking



# Why are notes useful?

- encoding hypothesis: when a person is taking notes, "the processing that occurs" will improve "learning and retention."
- external-storage hypothesis: people learn by being able to review their (or other people's) notes.

# Note taking can be...

- generative (summarizing, paraphrasing, concept mapping)
- non-generative (verbatim copying, shallow cognitive processing)

# Study 1

- Between-subjects design
- 67 students (33 M, 33 F, 1 unknown)
- Watched 15 minutes TED talks in couples
- Took notes in their preferred style
- Went to another room – 30 minutes general cognitive activity
- Answered factual-recall questions and conceptual-application questions

# Examples of questions

- Factual:

how many years ago  
did Indian civilization  
exist?

- Conceptual:

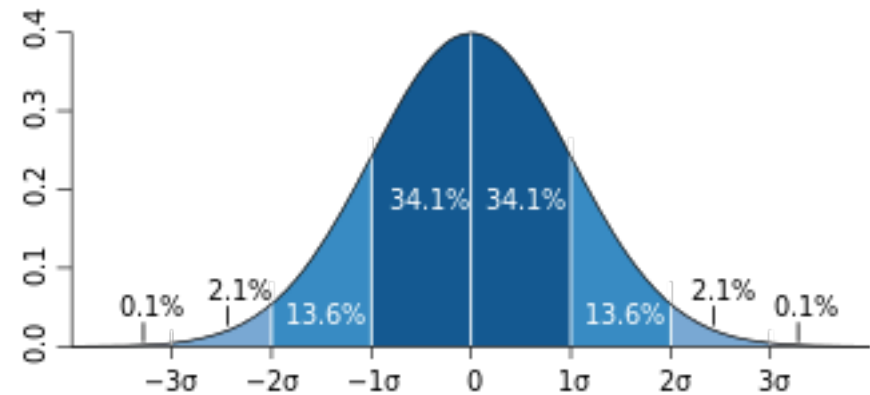
How do Japan and  
Sweden differ in their  
approach to equality  
within their society?

# Z score

$$Z = \frac{X - \mu}{\sigma}$$

$\mu$  is the average of  $x$   
 $\sigma$  is the standard deviation

$$\sigma_X = \sqrt{\frac{\sum_{i=1}^N (x_i - \bar{x})^2}{N}},$$





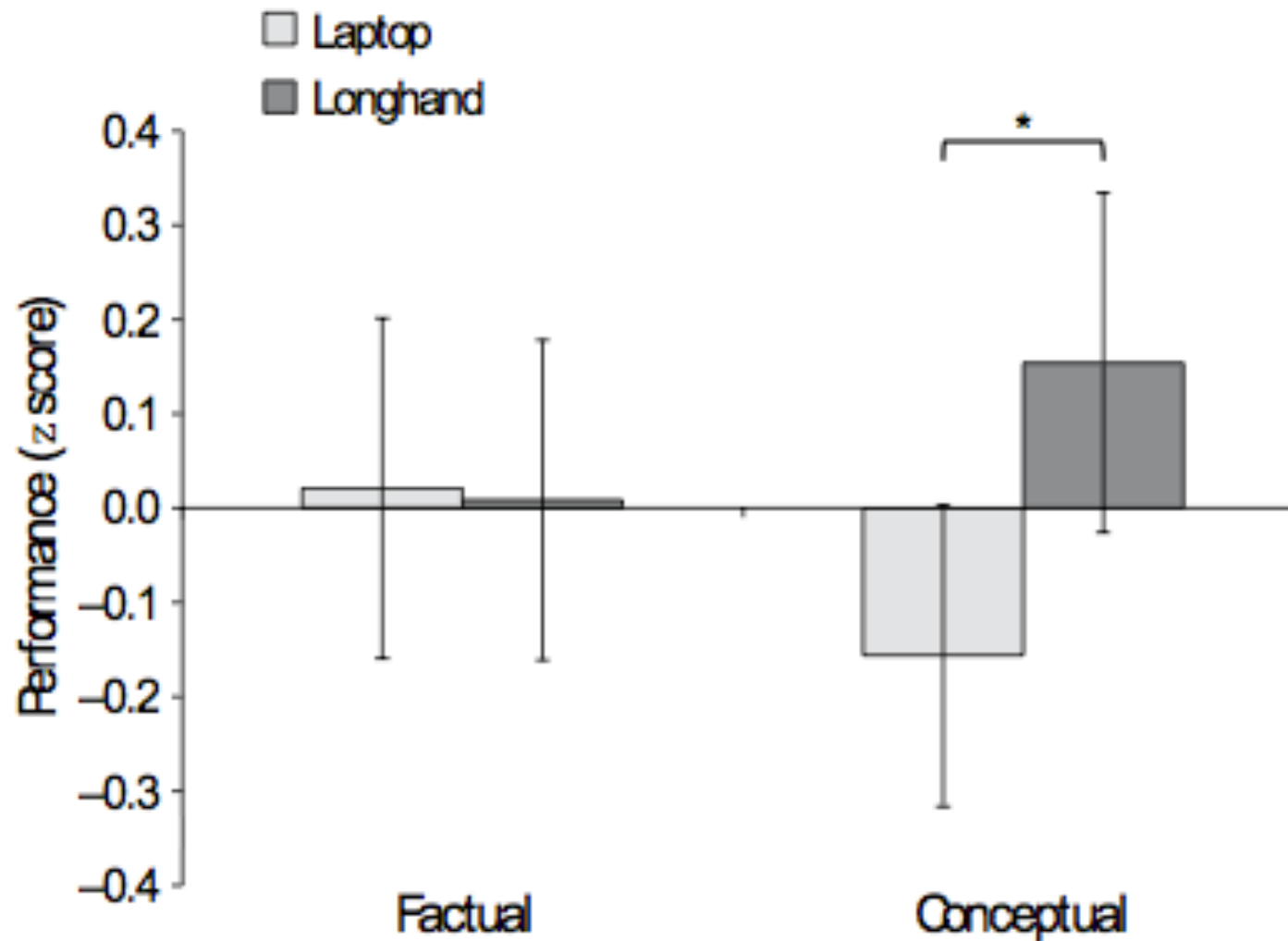


Fig. 1. Mean z-scored performance on factual-recall and conceptual-application questions as a function of note-taking condition (Study 1). The asterisk indicates a significant difference between conditions ( $p < .05$ ). Error bars indicate standard errors of the mean.

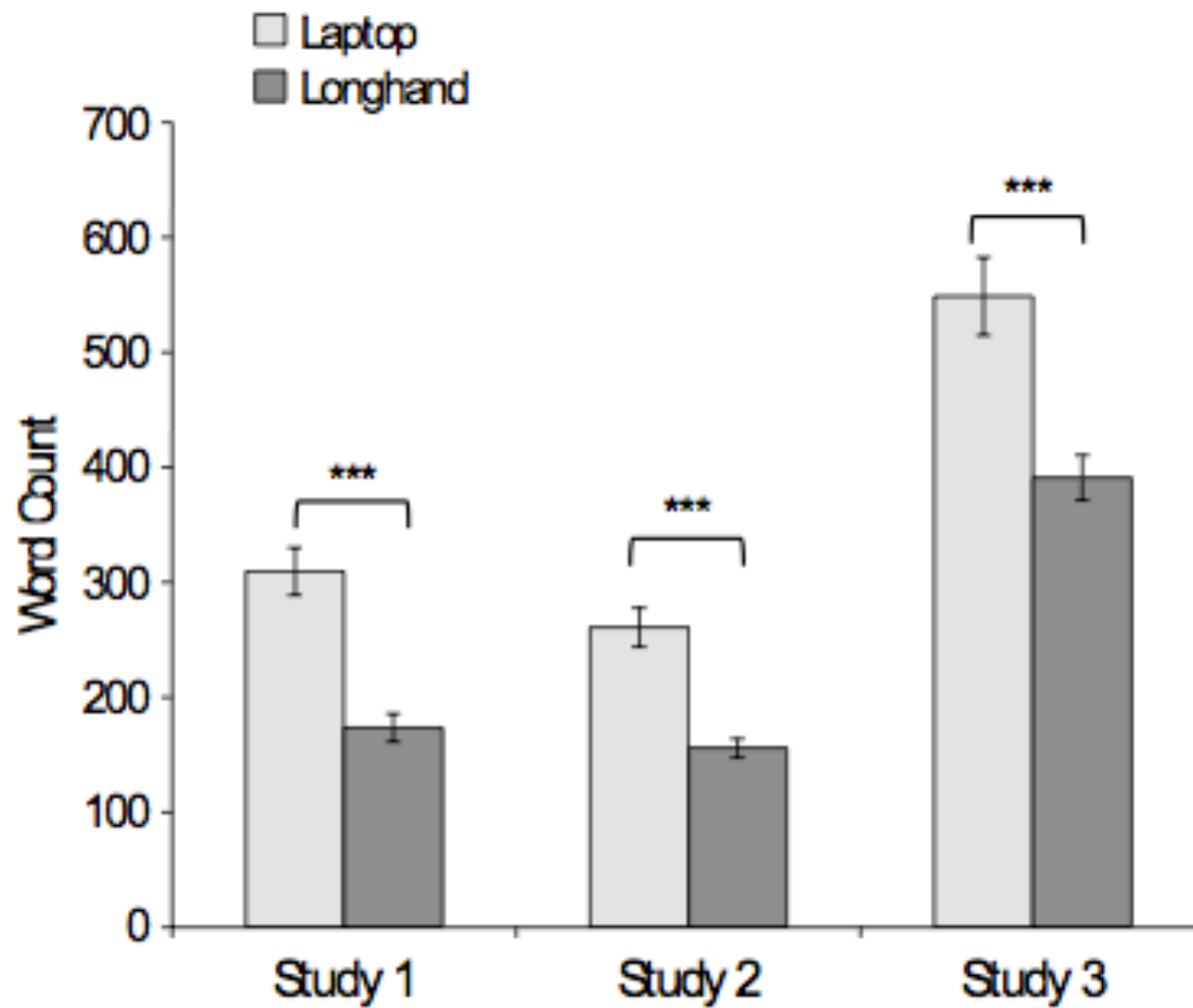


Fig. 2. Number of words written by students using laptops and notebooks in Studies 1, 2, and 3. Asterisks indicate a significant difference between conditions ( $p < .001$ ). Error bars indicate standard errors of the mean.

# Why Measure of verbatim transcription

- Comparison of trigrams between lecture text and notes
- Laptop: 14,6%
- Longhand: 8,8 %

# Why are hand notes more useful?

- Typing: people tend to try to take verbatim notes and write down as much of the lecture as they can
- Writing: people are more selective —you can't write as fast as you can type -- that extra processing benefit them

# Study 2

- INSTRUCTIVE MANIPULATION
- Between-subjects design 3 conditions
- 151 students (35 M)
- Watched 15 minutes TED talks in groups

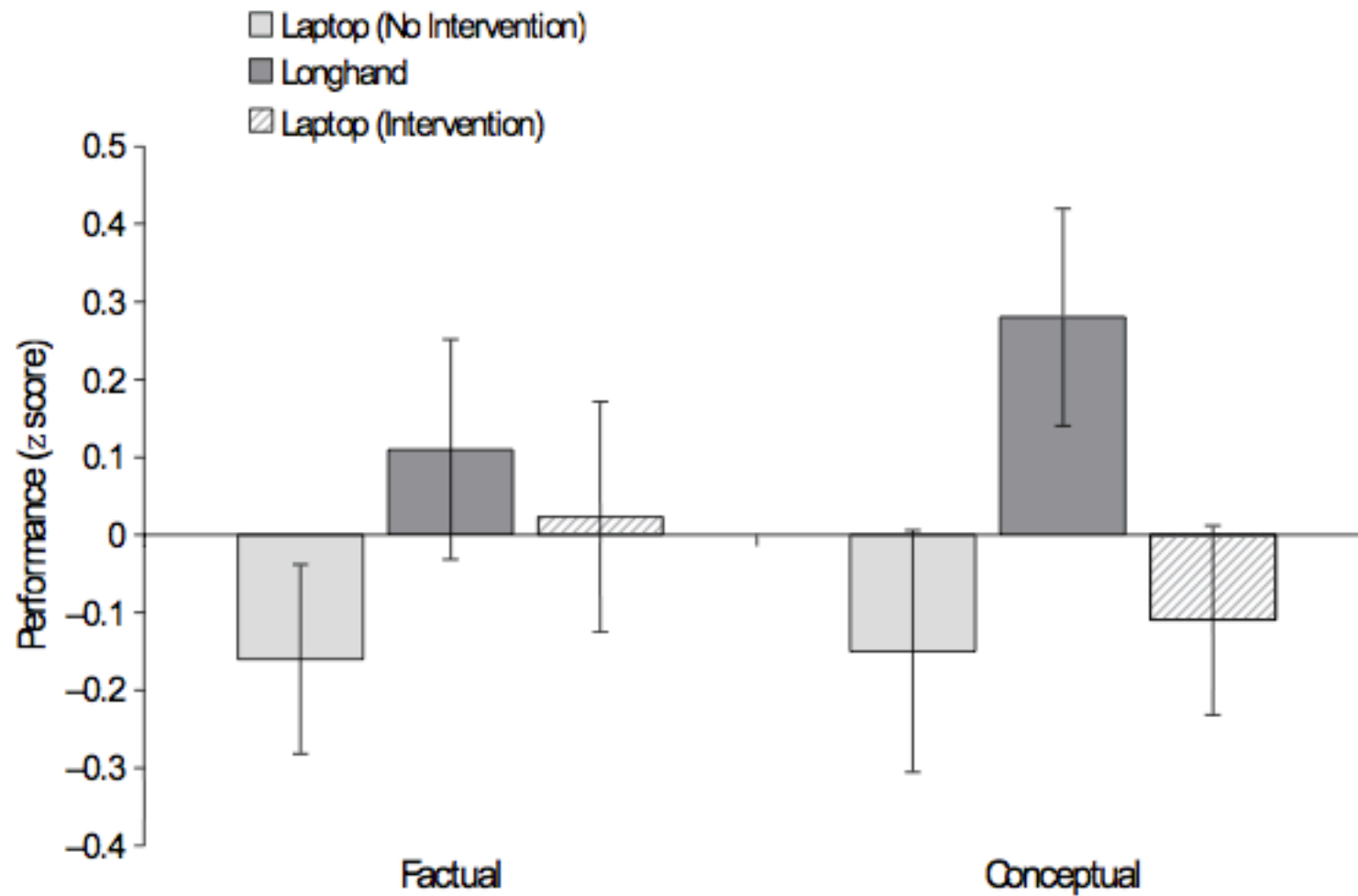


Fig. 4. Mean z-scored performance on factual-recall and conceptual-application questions as a function of note-taking condition (Study 2). Error bars indicate standard errors of the mean.

# Study 3

- 2 (laptop, long- hand)  $\times$  2 (study, no study) between subjects to investigate whether the disadvantages of laptop note taking for encoding are potentially mitigated by enhanced external storage.
- 109 students (27M)
- 7 min filmed lectures containing two “seductive details” (i.e., “interesting, but unimportant, information”)
- Returned one week later and in the study condition were given 10 minutes to review their notes
- Answered a set of facts questions: seductive details, concepts, same-domain inferences (inferences), and new-domain inferences (applications)

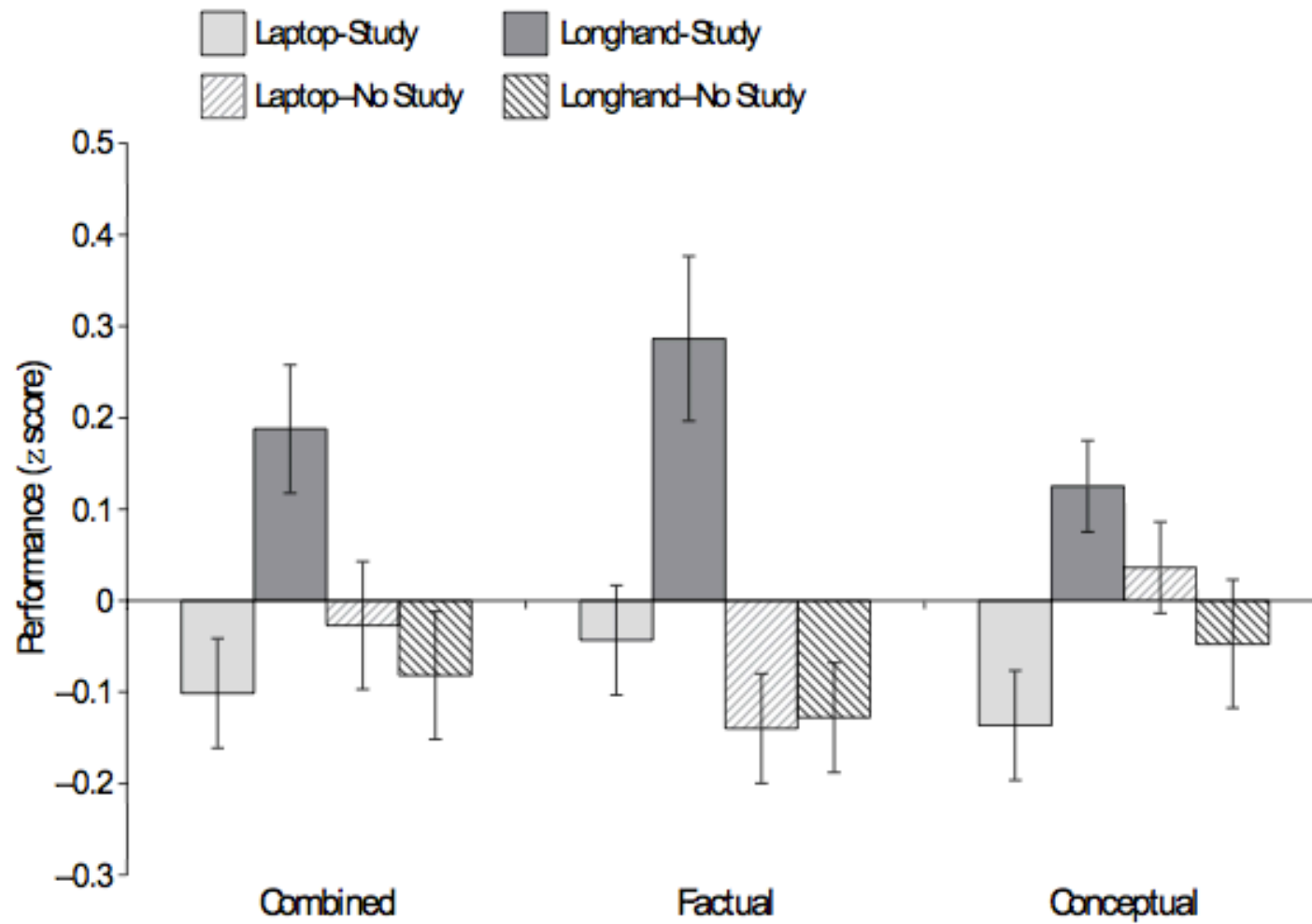


Fig. 5. Mean z-scored performance on factual-recall and conceptual-application questions as a function of note-taking condition and opportunity to study (Study 3). Combined results for both question types are given separately. Error bars indicate standard errors of the mean.



# Conclusions

- laptop use can negatively affect performance on educational assessments, even—or perhaps especially—when the computer is used for its intended function of easier note taking.
- Although more notes are beneficial, at least to a point, if the notes are taken indiscriminately or by mindlessly transcribing content, the benefit dis-appears.
- Synthesizing and summarizing content rather than verbatim transcription can serve as a desirable difficulty toward improved educational outcomes. For that reason, laptop use in classrooms should be viewed with a healthy dose of caution; despite their growing popularity, **laptops may be doing more harm in classrooms than good.**

# Old wisdom says...

I hear and I forget.

I see and I remember.

I do and I understand.

Confucius