An except from Mueller & Oppenheimer, 2014

STUDY 1

Participants were 67 students (33 male, 33 female, 1 unknown) from the Princeton University subject pool. Two participants were excluded, 1 because he had seen the lecture serving as the stimulus prior to participation, and 1 because of a data-recording error.

Materials: We selected five TED Talks https://www.ted.com/talks) for length (slightly over 15 min) and to cover topics that would be interesting but not common knowledge.2 Laptops had full-size (11-in. $\times$ 4-in.) keyboards and were disconnected from the Internet.

Procedure: Students generally participated 2 at a time, though some completed the study alone. The room was preset with either laptops or notebooks, according to condition. Lectures were projected onto a screen at the front of the room. Participants were instructed to use their normal classroom note-taking strategy, because experimenters were interested in how information was actually recorded in class lectures. The experimenter left the room while the lecture played. Next, participants were taken to a lab; they completed two 5-min distractor tasks and engaged in a taxing working memory task (viz., a reading span task; Unsworth, Heitz, Schrock, & Engle, 2005). At this point, approximately 30 min had elapsed since the end of the lecture. Finally, participants responded to both factual-recall questions (e.g., "Approximately how many years ago did the Indus civilization exist?") and conceptual-application questions (e.g., "How do Japan and Sweden differ in their approaches to equality within their societies?") about the lecture and completed demographic measures.

The first author scored all responses blind to condition. An independent rater, blind to the purpose of the study and condition, also scored all open-ended questions. Initial interrater reliability was good ($\alpha = .89$); score disputes between raters were resolved by discussion. Longhand notes were transcribed into text files.

The main results of this study were presented in a graph, shown below (Fig. 1). The y axis shows *z scores*, which are a way of comparing different scores on the same scale. The *average* value of data converted to a *z score* will always be zero.

Mueller, P. A., & Oppenheimer, D. M. (2014). The pen is mightier than the keyboard: Advantages of longhand over laptop note taking. Psychological science, 25(6), 1159-1168.

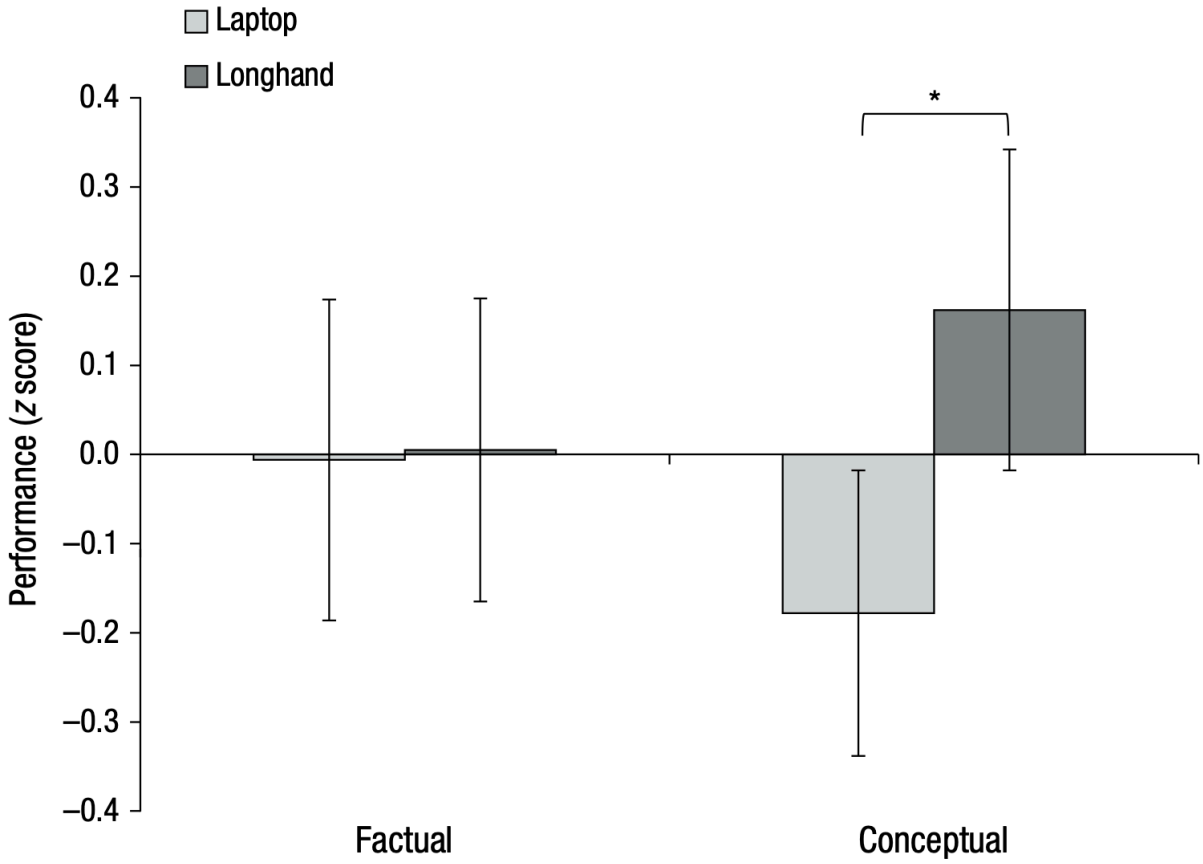

Fig. 1. Mean performance on factual-recall and conceptual-application questions as a function of note-taking condition (Study 1). Performance was converted to an index score where each question was worth 1 point, and the totals were *z*-scored across lectures. The asterisk indicates a significant difference between conditions ($p < .05$). Error bars indicate standard errors of the mean.

Figure 1: Fig 1. from Mueller et al.