Three Experimental Comparisons of Learner-generated versus Author-provided Graphic Organizers

Andrew T. Stull (stull@psych.ucsb.edu)
Richard E. Mayer (mayer@psych.ucsb.edu)
Department of Psychology, University of California, Santa Barbara
Santa Barbara, CA 93106-9660 USA

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Introduction

Science textbooks contain numerous pictures and illustrations, many of which may offer little more than seductive details (Harp & Mayer, 1998). In contrast, graphic organizers, visual-spatial structures that represent the conceptual organization of a body of text, are advocated to facilitate learning (Robinson & Kiewra, 1995) by helping learners select, organize, and integrate information with their existing knowledge (Mayer, 1979).

Two graphic organizer strategies are commonly advocated 1) providing learners with author-provided graphic organizers and 2) having learners construct their own. Paradoxically, provided graphic organizers might not engage learners in generative processing (Alvermann, 1981; Katayama & Robinson, 2000) and learner-constructed graphic organizers might be cognitively overwhelming (Kiewra, K. A., N. F. DuBois, D. Christian, & A McShane, M. Meyerhoffer, & D. Roskelley, 1991). This paradox suggests a tradeoff between promoting generative processes to facilitate meaningful learning and reducing cognitive engagement to address the learners' limited cognitive capacity (Chandler & Sweller, 1991).

This study explores the paradox by testing the hypothesis that learners using author-provided graphic organizers will perform better on knowledge transfer than learners constructing graphic organizers because they will experience lower cognitive load.

Method and Results

In three experiments, performance on knowledge transfer was compared for learners randomly assigned to read passages that contained either author-provided graphic organizers, learner-constructed graphic organizers, or a control (Experiment 1) or that contained either author-provided graphic organizers, learner-completed graphic organizer templates, or a control (Experiments 2 and 3).

In Experiment 1, there was no main effect of graphic organizer strategy, $F(2, 153) = 1.317$, $p = .271$. This result is attributed to excessive cognitive load caused by the passage design and the learner's poor familiarity with the graphic organizer technique. In Experiments 2, passages were modified to reduce cognitive load and learners were given additional training on graphic organizer construction. There was a main effect of graphic organizer strategy, $F(2,113) = 3.601$, $p = .030$. Learners who used author-provided graphic organizers ($M = 7.410$, $SD = 4.429$) performed better than learners in the learner-completed group ($M = 5.738$, $SD = 3.438$), $F(1,113) = 4.112$, $p = .045$, $d = 0.43$. Experiment 3 replicated Experiment 2 but with a passage designed to further reduce cognitive load. There was a main effect of graphic organizer strategy, $F(2,95) = 5.233$, $p = .007$. Learners using author-provided graphic organizers ($M = 9.182$, $SD = 4.066$) performed better than those in the learner-completed group ($M = 6.030$, $SD = 3.513$), $F(1,95) = 10.366$, $p = .002$, $d = 0.83$.

Discussion

Author-provided graphic organizers have the potential to promote meaningful learning when they support generative processes without causing excessive cognitive load.

Learner-constructed or -completed graphic organizers may cause excessive cognitive load, which limits the benefit of generative processing and inhibits learning.

Increased physical activity of the learner should not be construed to indicate increased learning.

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