Applying Cognitively-based Multimedia Principles to Classroom Slide Presentations Positively Affects Student Learning

Catherine E. Overson
Center for Excellence in Teaching and Learning

Background:

Multimedia instructional materials are used with growing frequency in a variety of college and university courses and settings. We should take care that our multimedia instruction is informed by what is known about how people learn, and in particular, by how people learn with words and pictures.

Multimedia learning refers to factual, conceptual, or procedural understanding that students develop from both words and pictures (Mayer, 2005, 2009). The theory of multimedia learning relates to how we receive and process information. These principles assume that we receive visual and auditory information from two distinct channels, both of which have a limited capacity. Overloading either of these channels can interfere with learning.

Prior studies tell us that people learn more and are better able to apply what they have learned when they are instructed with both words and pictures than when they are instructed with words alone (Mayer, 2005, 2009). Whether the learning benefits associated with applying multimedia principles to learning material generalize to authentic classroom settings is only recently being examined. For example, Issa, et al. (2011) found immediate learning benefits for third-year medical students who viewed slides on shock that had been modified using multimedia learning principles compared to students who viewed the same information on traditional slides.

The following two studies extend the work of Issa, et al. (2011) to examine whether Mayer’s multimedia principles (2009) hold up in authentic, ongoing undergraduate university courses, and demonstrate learning benefits to both immediate learning and retention of knowledge over an extended period of time.

Predictions:

I predict there will be:

- in Study 1, an immediate learning benefit for undergraduate students related to course material on slides that were modified using multimedia principles compared to course material on instructors’ original slides.
- in Study 2, a benefit in learning retention as demonstrated by performance on regularly scheduled in-class exams of course-related material on slides that were modified using multimedia principles when compared to course material on instructors’ original slides in an authentic, on-going classroom setting.


| Multimedia Principle: People learn better from words and pictures than from words alone (p. 223). |
| Coherence Principle: People learn better when extraneous material (words and pictures; sounds and music unneeded words and symbols) is excluded rather than included (p. 89). |
| Signaling Principle: People learn better when cues that highlight the organization of the material are added (p. 108). |

Participants:

- **Study 1**: Included faculty in two courses, Justice Studies (JS, 134 students) and Science and Nature of Human Stress (HS, 125 students).
- **Study 2**: Included faculty in two courses, Introduction to Child Life (CL 15 students) and Epidemiology and Community (EPI 57 students).

Procedure:

In both Study 1 and Study 2, for all multimedia-related course materials leading up to a scheduled in-class exam, half of each of the instructor’s original course daily slide presentations were randomly selected to present to students “as-is,” and the other half were modified according to Mayer’s (2009) multimedia principles (see examples, left). All students in the course experienced both conditions of slide presentation. Information content as set by the instructors was neither deleted nor expanded upon on the modified slides.

- **Study 1**: In order to evaluate immediate learning, faculty in JS and HS presented daily “quizzing” on both original and modified slide material at the end of each class.
- **Study 2**: In order to evaluate students’ retention of factual and conceptual understanding of multimedia-presented course material, Faculty in CL and EPI composed for their major in-class exams, questions that reflected the body of material presented on both original and modified course slide shows.

Results and Discussion:

- **Study 1**: JS students performed better on the modified slide daily quizzes ($M = 81.28\%$, $SD = 13$) compared to their quiz performance on the original slides ($M = 74.60\%$, $SD = 19$), $t(133) = 6.28$, $p < .001$, $d = 1.09$.

- **Study 2**: EPI students also performed better on modified slide daily quizzes ($M = 79.88\%$, $SD = 14$) compared to their quiz performance on the original slides ($M = 74.60\%$, $SD = 19$), $t(124) = 2.37$, $p < .05$, $d = .44$ (See Figure, left).

These two studies indicate that designing slides that are consistent with Mayer’s (2009) cognitive principles of multimedia learning can produce benefits to both short-term learning and long-term retention of academic material. Designing multimedia slides based on the science of learning is not only easy to do, it is an effective and efficient way to promote learning.

Contact Information for Catherine Overson: coverson@unh.edu or call 603-862-0902

This work is made possible by a grant from the Davis Educational Foundation.

The Foundation was established by Stanton and Elisabeth Davis after Mr. Davis’s retirement as chairman of Shaw’s Supermarkets, Inc.