Multimodal Learning Through Media: What the Research Says

By Metiri Group – Commissioned by Cisco

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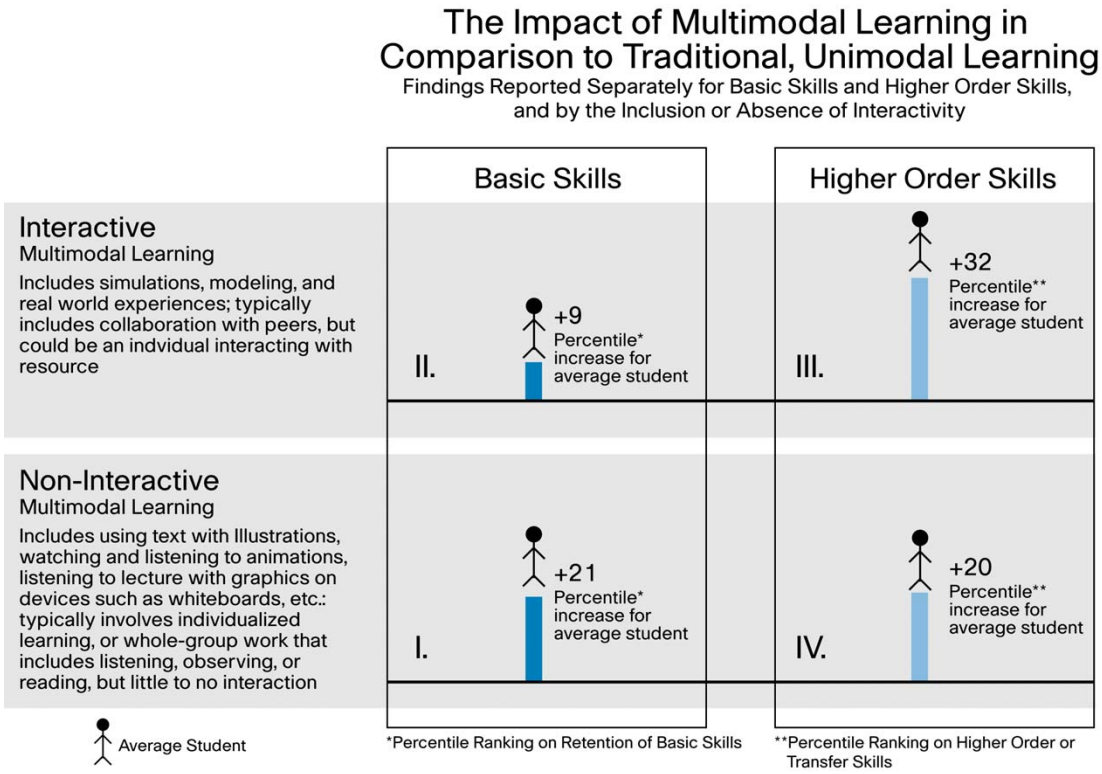
7b. **Individual Differences Principle:** Design effects are higher for high-spatial learners rather than for low-spatial learners.

8. **Direct Manipulation Principle:** As the complexity of the materials increase, the impact of direct manipulation of the learning materials (animation, pacing) on transfer also increases

New Web 2.0 technologies introduce some nuances to multimodal learning that warrant continued research. In practice educators are getting mixed, albeit positive trends in the use of multimedia to augment learning. **Students engaged in learning that incorporates multimodal designs, on average, outperform students who learn using traditional approaches with single modes.**

Figure 8 provides results from across multiple studies, separating effects related to basic and higher-order skills (see Appendix A for methodology and citations).

Figure 8. Impact of Multimodal Learning (Verbal and Visual)



The findings in Figure 8 are based on meta-analytic analysis and are summarized below:

- **Quadrants I and II:** The average student's scores on basic skills assessments increase by 21 percentiles when engaged in non-interactive, multimodal learning (includes using text with visuals, text with audio, watching and listening to animations or lectures that effectively use visuals, etc.) in comparison to traditional, single-mode learning. When that situation shifts from non-interactive to interactive, multimedia learning (such as engagement in simulations, modeling, and real-world experiences – most often in collaborative teams or groups), results are not quite as high, with average gains at 9 percentiles. While not statistically significant, these results are still positive.

- **Quadrants III and IV:** When the average student is engaged in higher-order thinking using multimedia in interactive situations, on average, their percentage ranking on higher-order or transfer skills increases by 32 percentile points over what that student would have accomplished with traditional learning. When the context shifts from interactive to non-interactive multimodal learning, the result is somewhat diminished, but is still significant at 20 percentile points over traditional means.

This analysis provides a clear rationale for using multimedia in learning. That said, the reader should be cautioned that the research in this field is evolving, with recent articles suggesting that efficacy, motivation, and volition of learners, as well as the type of learning task and the level of instructional scaffolding, can weigh heavily on the learning outcomes from the use of multimedia.[35] [36] [37]

Conclusion

The complexity of teaching and learning becomes increasingly apparent as the physiological, cognitive, social, and emotional aspects of learning become known. The percentages related to the cone of learning were a simplistic attempt to explain very complex phenomenon. The reality is that the most effective designs for learning adapt to include a variety of media, combinations of modalities, levels of interactivity, learner characteristics, and pedagogy based on a complex set of circumstances.

In general, multimodal learning has been shown to be more effective than traditional, unimodal learning. Adding visuals to verbal (text and/or auditory) learning can result in significant gains in basic and higher-order learning. The meta-analytic findings in this report provide insights into when interactivity augments multimodal learning of moderately to complex topics, and when it is advantageous for students to work individually when learning or building automaticity with basic skills.

Future Research

The opportunity for future original research and meta-analytic studies in this field is tremendous.

First, there continues to be opportunities to ask more specific research questions related to multimodal learning through high-tech media. Based on the meta-analytic findings in this report, another logical probe would be the differentiation between interactivity related to collaboration and that between a student and the software or Web resources.

The emphasis of the most multimedia studies to date has been on the impact on students' cognitive structures and processes only. Educators and researchers are now asking questions related to:

- **The social affordances that multimedia representations provide.** For example, Robert Kozma conducted research using multimedia representations in high school chemistry classes. His project simulated scientists' use of investigative laboratory activities to provide support discussions, studies, and argumentation that result in the construction of shared understandings of scientific phenomena.[38] Given the multiplicity of opportunity for social networking, collaborations, and student-student, student-instructor, and student-resource interactions, the complexities of the research need to become more specific and fine-grained.[39] [40]
- **The scaffolding required to prepare students to effectively use multimedia, visual representations.** Many authors speculate that unless students have been trained to interpret visuals, the impact of multimedia will be minimal. For example, Roth and Bowen (2001) suggest that graph-related practices are skill sets that set scientists apart and are