CHAPTER 7

The Multimedia Principle

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Abstract

The *multimedia principle* states that people learn better from words and pictures than from words alone. It is supported by empirically derived theory suggesting that words and images evoke different conceptual processes and that perception and learning are active, constructive processes. It is further supported by research studies that have found superior retention and transfer of learning from words augmented by pictures compared to words presented alone and superior transfer when narration is accompanied by animation compared to narration or animation presented alone. Research has also found that the effectiveness of combining imagery with text varies with the content to be learned, the conditions under which performance is measured, and individual differences in spatial ability, prior knowledge, and general learning ability. Cognitive theory derived from these findings posits interactions between three stages of memory – sensory, working, and long term – that are connected by cooperative, additive channels used to process information arriving from different sensory modalities.

The Multimedia Principle

It is commonly assumed that adding pictures to words, rather than presenting text alone, makes it easier for people to understand and learn. The proverb that a picture is worth a thousand words attests to the popularity and acceptance of this assumption. The assumption leads to what may be called the *multimedia principle*. This principle, as stated by Mayer (2001), is that people learn better from words and pictures than from words alone, or, more specifically, that people learn more or more deeply when appropriate pictures are added to text (Mayer, in press).

This chapter addresses these possibilities with findings drawn from empirical research. It reviews their foundations in both cognitive theory and empirical research and their practical application to instructional design. It also identifies gaps in the research and suggests efforts that might help to fill them.

Of course adding pictures to text is not equally useful for all situations or all people. For instance, the profusion of pictures in children's books decreases markedly as the age of the readers rises toward adulthood.

(Tobias, 1976, 1982, 1989) that adding support such as graphics and pictures to instruction is especially beneficial for students with limited prior knowledge of the domain they are learning. Tobias's instructional support hypothesis also predicts that adding graphics is of little benefit to students with substantial prior knowledge. Among other matters, this chapter examines whether pictures may be differentially beneficial for students varying in prior familiarity with the subject they are about to learn.

While publishers have augmented text with pictures or graphics for a long time, enhanced interest in this topic arises from the instructional success and popularity of computer-based presentations (Fletcher, 1991, 2004), which allow ready access to a full range of multimedia and which may be used standing alone or over the Internet. In such materials, graphics, still and animated pictures, video, voice, music, and sound effects may accompany text. Mayer (2001, p. 3) defines *multimedia learning* as "learning from words and pictures," and the term will be so used in this chapter.

This chapter, then, focuses on visual imagery used to enhance learning materials that would otherwise be presented solely as text. This emphasis responds to available research findings and the cognitive theories discussed in this chapter. Other media such as voice, music, and sound effects might also be used to enhance learning from text presentations and may reasonably be included in later discussions of the multimedia principle as research on them progresses. Tactile and haptic capabilities are additional multimedia possibilities (e.g., Youngblut, 2003), but these are not discussed here, again reflecting the current state of empirical findings.

Finally, this chapter attempts to avoid the issues that arise from comparisons involving the instructional effectiveness of different media. Media comparisons have been the subject of considerable and often inconclusive research (Clark, 1983, 2001; Russell, 2001; Russell, Bernard, Abrami, Lou, Wade, Fiset, & Wozney, 2003; Schramm, 1977). Students never present exactly the same instructional material (Fletcher, 2003). Clark and others have argued that media alone have little effect on instructional outcomes unless different media engage alternative cognitive processes that control learning.

This position is similar to one articulated by Tobias (1982) who pointed out that varying instructional methods – media based or otherwise – can lead to different outcomes only if they engage different cognitive processes, or if one method leads to more intensive processing than another. Mayer (1997) reanalyzed nine studies that compared instructional material presented using text and graphics on the one hand and computer animation and narration on the other and found only minor differences between the media. These findings suggest simply that it is not the media that matter, but how they are used.

The basic question examined in this chapter, then, is whether augmenting text with graphic presentations, or vice versa, leads to improved learning. Such augmentations are presumed to lead to more intense or improved cognitive processing of instructional material, which, in turn, will enhance instructional effectiveness.

Theoretical Foundations

Why should we expect the multimedia principle to work? Like most ideas, psychological theory included, this expectation has its basis in philosophy. The 18th-century philosophy of Bishop George Berkeley may have been seminal in this case. Berkeley believed that nothing exists or has meaning unless it is perceived by some mind.[1] Words and images are important because they give both existence and meaning to matter. But Berkeley pointed out that words are abstract and generic while images are concrete and specific. The word *tree* will bring different

in mind.

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