The Ideal Learning Management System for Multimedia Learning

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Introduction

Learning occurs in many different ways. We learn from listening to words, and to ambient sounds in the environment, what R. Murray Schafer (1977) calls "the soundscape". We learn from text, especially when it is relevant to what we are searching for, and, we learn from images, both still and moving. We learn from others, as most learning has a social and cultural component, and we learn from activities – from doing things that are related to what we want or need to learn.

Early attempts at teaching online started with simple stick figures or blocks of text on monochrome screens. In many ways, this approach to teaching online can be seen as a form of "sensory deprivation," because there is so little data for the senses to process, compared with our experiences of learning in the offline world (Davis et al, 2007). As humans, our senses are used in parallel to process information coming through multiple communications channels at the same time. We enjoy and respond to "rich media" that combines several "learning modalities" into one integrated learning experience.

Richard Mayer (2005) and many others have termed this approach to online learning as "multimedia learning," and have carried out extensive research on how this needs to be done. This white paper reviews the theory and research on multimedia learning, and introduces you to the idea of multimedia learning management systems (MLMSs) that allow you to combine several different learning modalities into a rich online experience for learners of all ages. With a multimedia learning management system, learners can receive, send and interact with a wide variety of multimedia resources, using different learning modalities.

Multimedia Learning Principles

According to Richard Mayer (2005), "People can learn more deeply from words and pictures than from words alone." By "words" Mayer means either text or spoken words, and by "pictures" he means illustrations, photos, animations, or video. There is an assumption in his research that two channels – visual and auditory – can work together within certain design guidelines, and when combined, will reinforce each other leading to better learning outcomes (see Figure

1). In addition, Low and Sweller (2005) argue that "under certain, well-defined conditions, presenting some information in visual mode and other information in auditory mode can expand effective working memory capacity and so reduce the effects of excessive cognitive load... It is an instructional principle that can substantially increase learning."

Mayer's "multimedia learning hypothesis" is backed up by an extensive amount of research, and is supported by Allan Paivio's Dual-coding Theory (Paivio, 1986) that postulates that both visual and verbal information are processed differently using distinct channels within the human mind. According to this theory, the mind creates separate representations for the information processed in each channel. For Paivio, mental images are *analogue* codes, while the verbal representations of words are *symbolic* codes. Both visual and verbal codes for representing information are used to organize incoming information into knowledge that can be acted upon, stored, and retrieved for subsequent use.
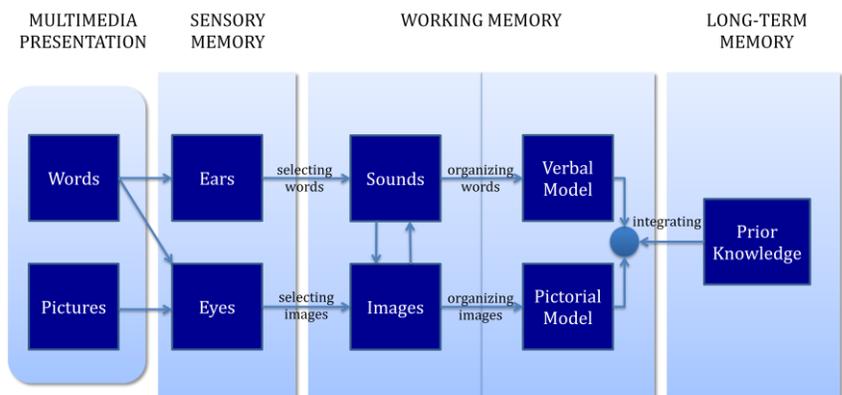
Figure 1 – Cognitive processes involved in multimedia learning. (Mayer, 2005)

Mayer has proposed two sets of principles of multimedia learning, a basic set, and an advanced set. Both sets of principles have been supported by a large number of empirical research studies (See Mayer, 2005 for reviews of this literature). The basic principles are:

1. *Multimedia principle* – people learn better from words and pictures than from words alone.

2. *Split-attention principle* – people learn better when words and pictures are physically and temporally integrated.

3. *Modality principle* – people learn better from graphics and narration than graphics and printed text.

4. *Redundancy principle* – people learn better when the *same* information is *not* presented in more than one format.

5. *Segmenting, pre-training, and modality principles* – people learn better when the multimedia messages are presented in learner–paced segments rather than as a continuous unit, people learn better from a multimedia message when they know the names and characteristics of the main concepts, and people learn better from a multimedia message when the words are spoken rather than written.

6. *Coherence, signaling, spatial contiguity, temporal contiguity, and redundancy principles* – people learn better when extraneous material is excluded rather than included, when cues are added that highlight the organization, the essential material, and corresponding words and pictures are presented near rather than far from each other on the screen or page or in time, and people learn better from graphics and narration than from graphics, narration, and on-screen text.

7. *Personalization, voice, and image principles* – people learn better when the words of a multimedia presentation are in conversational style rather than formal style and when the words are spoken in the standard accented human voice rather than a machine voice or foreign accented human voice; but people do not necessarily learn better when the speaker's image is on the screen. (adapted from Mayer, 2005).

In addition to these basic principles of multimedia learning, Mayer also articulates a set of advanced principles supported by research. These are:

1. *Guided-discovery principle* – people learn better when guidance is incorporated into discovery based multimedia environments.

2. *Worked-out example principle* – people learn better when they receive worked-out examples in initial skill building.

3. *Collaboration principle* – people can learn better with collaborative online learning activities.

4. *Self-explanation principle* – people learn better when they are encouraged to generate self explanations during learning.

5. *Animation and interactivity principles* – people do *not* necessarily learn better from animation than from static diagrams.

6. *Navigation principles* – people learn better in hypertext environments when appropriate navigation aids are provided.

7. *Site map principle* – people can learn better in an online environment when the interface includes a map showing where the learner is in the lesson.

8. *Prior knowledge principle* – instructional design principles that enhance multimedia learning for novices may hinder multimedia learning for more expert learners.

9. *Cognitive aging principle* – instructional design principles that effectively expand working memory capacity are especially helpful for older learners. (adapted from Mayer, 2005)

In terms of teaching with multimedia, Mayer proposes three metaphors of how learning using multimedia can take place - response strengthening, information acquisition, and knowledge construction. Response strengthening is making better connections between different sets of information or procedures. This can be carried out through a set of repetitive exercises - drill and practice. Information acquisition adds new facts to memory, and an online presentation is one way to deliver the new information. Knowledge construction is building a coherent mental structure for each learner as they try to make sense of the world. In this role, an online teacher is really a cognitive guide for helping learners to construct their own view of the world, and needs to be able to communicate and give feedback to the online learner. All three learning metaphors are possible with a properly designed multimedia learning management system.

Beyond these three basic approaches to teaching and learning, there is a need for pedagogical theories and models for overall course and curriculum development; that is, how do you best develop educational programs which contain a mix of educational media, including text, images, speech, practical assignments, collaboration, and social networking? At the same time, such a system needs to be easy to use in terms of authoring, synchronizing, and finding materials, and connecting instructors and students. It also needs to be easy to administer.

Jeron van Merriënboer and Liesbeth Kester (2005) identify four components of well-designed learning environments:

1. *Learning tasks* – learners need to be given meaningful whole-task experiences and worked out examples that are based on real-life problems.

2. *Supportive information* – learners need to receive information that builds a bridge between what they already know and what may be helpful to know in order to work on the learning task.

3. *Procedural information* – learners usually need to receive information before they start their learning task that gives them an idea of what to do in order to perform what is expected of them.

4. *Part-task practice* – complex tasks may have to be broken down into parts for individual practice in order for the learner to reach the required level of automaticity as a learning outcome.

Multimedia offers a wide range of instructional options that if designed properly, decrease the amount of time that it takes to learn something, involves less time for experts to be teaching, and reduces the overall cost of learning (Clark, 2001).

A Multimedia Learning Management System

Based on the above theory and research, what would a learning management system that was supportive of multimedia learning look like? To start, it would ideally have two separate screens to present material in visual and verbal modalities. In order to increase attention and engagement, one of the two screens would ideally show video of a person as a teacher, or an animation that illustrated a particular process or procedure. But, it also would need the flexibility of instructors being able to use a single screen, switching to a dual screen mode as needed, while making sure that words and pictures are physically and temporally integrated (See Figure 2).

F**igure 2** – Integrating words and narration supports multimedia learning.

In order to support collaboration, such a learning management system would need facilities for social media in order to have learners work together, or to interact with their instructors. Social networking and links to websites would need to be built-in, because of the rich repository of materials that are available on the Internet.

Because learning materials are often available as documents, the system would have a library where electronic documents and worked-out examples can be downloaded as assigned, or as desired by a learner. In order to personalize the learning experience, the design of learning materials would need to be modular and in small units that can be combined and repurposed depending on the needs of any given individual learner.

Learners are sometimes not at a location where they can connect to the Internet, so the ideal system would need to play and present materials off-line when there is no connection. When there is a connection, the ideal MLMS should be "cloud-based" - able to provide learning materials and experiences from any location rather than from a specific server.

Instructors are busy people, so the MLMS should have a method for rapid authoring of content or easy integration with authoring tools. Moreover, it should be easy to synchronize videos or animations on one screen with images and text on the other.

Of course, such an MLMS should have standard features in common with other learning management systems. For example, it needs to serve multiple communities within the same organization. It needs to be intuitive and easy to use for learners to navigate and find what they need. You need to be able to take notes as you interact with learning materials, and make comments that are available for others to read.

Finally, the system needs to be easy to use for administration, tracking, recording and reporting. The materials produced within the system need to be exportable to mobile devices and other formats.

The Brandon Hall Group tracks over 120 learning management systems, and has found very few LMSs that allow for a dual screen multimedia learning experience combined with document management, and several types of social media. One LMS that has all these features is the *Knoodle* learning management system (www.knoodle.com), which can carry out all the functions of a MLMS described above. Knoodle's unique modular design, and its ability to synchronize moving images with still images on two screens makes it an ideal learning management system for multimedia learning. Microsoft PowerPoint can be used for rapid authoring, and video and animations are becoming easier to produce as personal media

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technologies advance. Syncing the two types of media in Knoodle is a cinch, as shown in Figure 3. Once you have a dual panel presentation created it can be exported as a MP4 movie file for off-line and mobile device viewing.
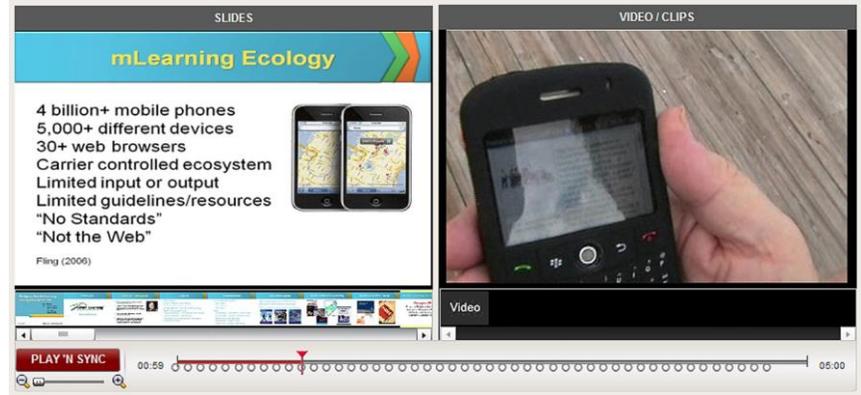
Figure 3 - A multimedia learning management system needs to synchronize the various types of media available for learning

The research approach of Richard Mayer and Ruth C. Clark has many followers, and, as the importance of using a multimedia approach becomes more important, look for more learning management systems to have these features.

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