

Mayer, R., (2009). Multi-Media Learning, 2nd Ed. Cambridge University Press, NY

Summary Notes

5/25/09

H. Johnson/Michigan State University

How can we design multimedia enhanced instruction that matches how individuals learn?

If we were more effective in our design and use of multimedia, would the academic performance of students who are d/hh be significantly improved?

p. 272

"There is converging evidence that high-quality multimedia design is more important for low-rather than high-experience learners."

= students that experience the greatest difficulty learning are very likely to experience the greatest benefit from the effective multimedia design



Mayer, R. (2009). Multimedia Learning, 2nd Ed. Cambridge University Press, NY

Chapter 1: The Promise of Multimedia Learning

p. 13

"...multimedia designs that are consistent with the way the human mind works are more effective in fostering learning than those that are not."

= student learning can be improved via effective multimedia design, design based on not what can be done, or what seems interesting/innovative, but based on how we learn

p. 17

"...the learner is an active sense-maker who experiences a multimedia presentation and tries to organize and integrate the presented material into a coherent mental representation...the teacher's job is to assist the learner in this sense-making process...the goal of multimedia presentations is not only to present information, but also to provide guidance for how to process the presented information....multimedia is a sense-making guide, that is, an aide to knowledge construction."

= student as an individual who is actively trying to understand

= teacher as the individual responsible for assisting/guiding students in developing targeted understanding

= multimedia instruction as a instructional mechanism

= goal is now how much information is remembered, but how deeply the information is understood, as indicated by the individuals ability to use it to solve novel problems

Chapter 2: The Science of Instruction: Determining What Works in Multimedia Learning

p. 33-34

analysis of illustrations in text...coding schema

= existing protocol we can use to analyze curricular text commonly used with students who are d/hh

p. 51

first listing of "effectiveness of twelve features of our multimedia lessons:"

Chapter 3: The Science of Learning: Determining How Multimedia Learning Works

p. 57

Cognitive theory of multimedia learning...three essential elements:

1. dual-channel assumption
2. limited-capacity assumption
3. active-processing assumption

= individuals learn through their use of two perceptual channels, i.e., seeing and hearing
= each channel has a limited amount of information it can process at any one time
= individuals actively try to make sense of that they see and hear through association with previous experiences/understanding

= teachers have the responsibility assist their students in their sense making efforts

p. 60

"Decisions about how to design a multimedia message always reflect an underlying conception of how people learn."

p. 60

Five kinds of knowledge:

1. facts - "knowledge about characteristics of things or events, such as 'Sacramento is the capital of California,'"
2. concepts - "knowledge of categories, principles, or models such as knowing what a dog is or how a pulley system works,"
3. procedures - "knowledge of specific step-by-step processes, such as how to enter data into a spreadsheet,"
4. strategies - "knowledge of general methods for orchestrating one's knowledge to achieve a goal, such as knowing how to break a problem into subparts, and"
5. beliefs - "cognitions about oneself or about how one's learning works, such as the belief that 'I am not good at math.'"

Chapter 4: Coherence Principle

p. 89

Coherence Principle = "People learn better when extraneous material is excluded rather than included."

Traditional role of teachers...one that is based on an information processing model of instruction...

p. 93

"...knowledge transmission - the idea that learning involves taking information for the teacher and putting it into the learner."

Alternative role of teachers...one that is based on a cognitive processing model of instruction...

p. 95

"...knowledge construction - the idea that learners actively build mental representations based on what is presented and what they already know."

p. 106

Implications for Multimedia Instruction = "Do not add extraneous words and pictures to multimedia presentations. Do not add unneeded sounds and music to multimedia presentations."

Chapter 5: Signaling Principle

p. 108

Signaling Principle = "People learn better when cues that highlight the organization of the essential material are added."

p. 117

Implications for Multimedia Instruction = "When a learner might otherwise be tempted to focus on extraneous material in a multimedia lesson, signaling should be used to guide the learner's cognitive processing."

Ch 6: Redundancy Principle

p. 118

Redundancy Principle = "People learn better from graphics and narration than from graphics, narration, and printed text."

p. 133

"...do not add on-screen text that duplicates words that are already in the narration."

p. 133

Implications for Multimedia Instruction = "...do not add on-screen text that duplicates words that are already in the narration."

Ch. 7: Spatial Contiguity Principle

p. 135

Spatial Contiguity Principle = "Students learn better when corresponding words and pictures are presented near rather than far from each other on the page or screen."

p. 151

Implications for Multimedia Instruction = "Present words and pictures near rather than far from each other."

Ch. 8: Temporal Contiguity Principle

p. 135

Temporal Contiguity Principle = "Students learn better when corresponding words and pictures are presented simultaneously rather than successively."

p. 167

Implications for Multimedia Instruction = "Present corresponding words and pictures at the same time rather than far from each other in time."

Ch. 9: Segmenting Principle

p. 175

Segmenting Principle = "People learn better when a multimedia message is presented in user-paced segments rather than as a continuous unit."

p. 175

"In viewing a fast-paced narrated animation that explains the steps in a process, some learners may not fully comprehend one step in a process before the next one is presented, and thus, they may not have time to see the causal relation between one step and the next."

p. 180

"...the segmented versions allowed the learners to digest a portion of the narrated animation before moving on to the next."

p. 181

"The essence of the segmenting principle is that when the essential material is too complex for the learner to grasp it all at once, the material should be broken down into smaller segments that the learner studies sequentially."

p. 186

Implications for Multimedia Instruction = "When the essential material in a narrated animation is too complex - that is, when processing the essential material requires more

capacity that is available to the learner - then break the narrated animation into meaningful segments that can be presented under the learner's control."

Ch. 10: Pre-Training Principle

p. 189

Pre-Training Principle = "People learn more deeply from a multimedia message when they know the names and characteristics of the main concepts."

p. 189

"In viewing a fast-paced narrated animation that explains the steps in a process, learners have to mentally construct a causal model of the system (i.e., a model of how the system works) as well as component models for each key part in the system. Pre-training can help manage these two demands for essential processing by distributing some processing to a pre-training episode that occurs before the main lesson."

p. 193

"...pre-training provides prior knowledge that reduces the amount of processing needed to understand the narrated animation."

p. 193

"Students who have appropriate prior knowledge already know the names and characteristics of the key components, so they can devote their cognitive resources to building a causal model."

p. 198

Implications for Multimedia Instruction = "When students would be overwhelmed by a multimedia lesson that uses many new terms to explain complex material, provide pre-training concerning the key terms before presenting the lesson."

Ch. 11: Modality Principle

p. 200

Modality Principle = "People learn more deeply from pictures and spoken words than from pictures and printed words."

p. 200

"In the animation-with-on-screen-text version, both pictures and the words enter the cognitive system through the eyes, causing an overload in the visual system. In the animation-with-narration version, the words are off-loaded onto the verbal channel, thereby allowing the learner to more fully process the pictures in the visual channel."

p. 207

"According to the cognitive theory of multimedia learning, the processes required for meaningful learning cannot be fully carried out when the visual channel is overloaded..."

p. 218

Implications for Multimedia Instruction = "When making multimedia presentations consisting of animation and words, present the words as narration rather than as on-screen text."

"There may be situations in which printed text can foster meaningful learning, especially when it is used in a way that is consistent with the spatial contiguity principle. Printed words may also be appropriate when learners are non-native or hearing impaired or when lessons contains hard-to-pronounce words and symbols."

Ch. 12: Multimedia Principle

p. 223

Multimedia Principle = "People learn better from words and pictures than from words alone."

p. 223

"When words and pictures are both presented, learners have an opportunity to construct verbal and visual mental models and to build connections between them."

p. 228

"The instructor's job is not only to present material but also to help guide the learner's cognitive processing of the presented material."

p. 229

"...the act of building connections between verbal and pictorial mental models is an important step in conceptual understanding..."

p. 236

Categorization of text illustrations...

[possible model for the possible analysis of curricular material used with students who are d/hh]

p. 236

"...categorized each illustration as belonging to one of the following categories:

decorative = illustrations that are intended to interest or entertain the reader but that do not enhance the message of the passage, such as a picture of a group of children playing in a park for a lesson on physics principles;

representational = illustrations that portray a single element, such as a picture of the space shuttle with a heading, 'The Space Shuttle';

organizational = illustrations that depict relations among elements, such as a map or chart showing the main parts of the heart;

explanative = illustrations that explain how a system works, such as the frames explaining how pumps work in Figure 12.2.

The results were that the overwhelming majority of illustrations served no important instructional purpose; 23 percent were decorative and 62 percent were representational. By contrast, only a small minority of the illustrations enhanced the instructional message; 5 percent were organizational, and 10 percent were explanative. From this kind of analysis, we can conclude that the potential power of graphics is not being met."

p. 238

"Overall, research on illustrations in text yields two important results relevant to the multimedia effect: (a) textbook authors who add illustrations to their text often fail to take full advantage of the potential power of graphics as an aid to understanding, and (b) adding a carefully designed graphic advance organizer to a text passage can greatly enhance student understanding."

p. 240

Implications for Multimedia Instruction = "The multimedia principle is perhaps the most fundamental principle of multimedia design: Present words and pictures rather than words alone."

Ch. 13: Personalization, Voice & Image Principles

p. 242

Personalization Principle = "People learn better from multimedia presentations when words are in a conversational style rather than a formal style."

p. 242

Voice Principle = "People learn better when narration is spoken in a human voice rather than a machine voice."

p. 242

Image Principle = "People do not necessarily learn better when the speaker's image is added to the screen."

Ch. 14: Principles of Multimedia Design

1. reduce confusion re. what to attend to and what to ignore
2. increase support for organization & recognition of selected items
3. assist in linking current organization and recognition with past learning

p. 69

Five kinds of knowledge structure:

1. "Process structures can be represented as cause-and-effect chains and consist of explanations of how some system works." (e.g., how a oven works)
2. "Comparison structures can be represented as matrices and consist of comparisons among two or more elements along several dimensions." (e.g., comparative work or a teacher vs. a student)
3. "Generalization structures can be represented as a branching tree and consists of a main ideas with subordinate supporting details." e.g., the outline of a chapter
4. "Enumeration structures can be represented as list and consist of a collection of items." e.g., a grocery list
5. "Classification structure can be represented as hierarchies and consists of sets and subsets." e.g., types of birds and their major characteristics

p. 69

"Multimedia design can be conceptualized as an attempt to assist learners in their model-building efforts."

p. 69

"...two important implications for multimedia design: (a) the presented material should have a coherent structure, and (b) the message should provide guidance for the learner on how to build the structure."