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

I. **A cognitive theory of multimedia learning assumes...**

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"A cognitive theory of multimedia learning assumes that the human information-processing system includes dual channels for visual/pictorial and auditory/verbal processing, each channel has limited capacity for processing, and active learning entails carrying out appropriate cognitive processing during learning."

A. **1. Dual-Channel Assumption...**

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"The dual-channel assumption is that humans posses separate information-processing channels for visually represented material and auditorily represented material."

B. **2. Limited-Capacity Assumption...**

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"The second assumption is that humans are limited in the amount of information that can be processed in each channel at one time."

C. 3. Active-Processing Assumption...

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"The third assumption is that humans actively engage in cognitive processing in order to construct a coherent mental representation of their experiences. These active cognitive processes include paying attention, organizing incoming information, and integrating incoming information with other knowledge."

II. Five steps in multimedia learning are...

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1. "...selecting relevant words from the presented text or narration,"

2. "...selecting relevant images from the presented illustrations,"

3. "...organizing the selected words in a coherent verbal representation,"

4. "...organizing the selected images into a coherent visual representation, and"

5. "...integrating the visual and verbal representations and prior knowledge."

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table 3.3

"Three Processes for Active Learning"

reorganization of the above

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"Each of these five steps in multimedia learning is likely to occur many times throughout a multimedia presentation."

III. **Effective instructional design depends on...**

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"Effective instructional design depends on techniques for reducing extraneous processing, managing essential processing, and fostering generative processing."

IV. **p. 60**

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

V. **p. 69**

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

A. **two implication...**

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"...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."

Definitions

I. **Learning...**

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"Learning is a change in knowledge attributable to experience."

II. **Active learning...**

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"Active learning occurs when a learner applies cognitive processes

to incoming material - processes that are intended to help the learner make sense of the material. The outcome of active cognitive processing is the construction of a coherent mental representation, so active learning can be viewed as a process of model building. A mental model (or knowledge structure) represents the key parts of the presented material and their relations."

Five kinds of knowledge...

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Anderson et al, 2001; Mayer & Wittrock, 2006)

I. **1. Facts...**

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facts - "knowledge about characteristics of things or events, such as 'Sacramento is the capital of California,"

II. **2. Concepts...**

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concepts - "knowledge of categories, principles, or models such as knowing what a dog is or how a pulley system works,"

III. **3. Procedures...**

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procedures - "knowledge of specific step-by-step processes, such as how to enter data into a spreadsheet,"

IV. **4. Strategies...**

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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"

V.   **5. Beliefs...**

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beliefs - "cognitions about oneself or about how one's learning works, such as the belief that 'I am not good at math."

Five kinds of knowledge Structures (types of understanding)...

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table 3.2

I.   **1. Process...**

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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)

II.   **2. Comparison...**

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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)

III.   **3. Generalization...**

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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

IV.   **4. Enumeration...**

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4. "Enumeration structures can be represented as list and consist of a collection of items." e.g., a grocery list

V.   **5. Classification...**

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5. "Classification structure can be represented as hierarchies and consists of sets and subsets." e.g., types of birds and their major characteristics