“Instructional media are mere vehicles that deliver instruction but do not influence student achievement any more than the truck that delivers our groceries causes changes in our nutrition.”

(Clark, 1983, p. 445)

What is multimedia?

“presenting both words and pictures.”
Multimedia Learning

What is multimedia learning?

Mayer: Building mental representations from words and pictures.

Schnotz: Using external representations as information sources to construct internal representations of learning content, and storing these representations in long-term memory.
What is the rationale for multimedia learning?

Multimedia principle:
People learn more deeply from words and pictures than from words alone.

Desired Learning Outcomes
- Remembering (Retention)
- Understanding (Transfer)

What does the multimedia principle predict?
Discuss its implication for the design of multimedia learning environments. Consider:
- the modalities/presentation modes used
- the type of learning fostered
- the learning outcomes achieved
Report a summary of your thoughts to the class.

Multimedia Learning as Information Acquisition
- Teacher: Information provider
- Learner: Passive recipient
- Content: Information
- Goal: Add information to memory
- Multimedia: Delivery vehicle

Multimedia Learning as Knowledge Construction
- Teacher: Information provider
- Learner: Passive recipient
- Content: Information
- Goal: Add information to memory
- Multimedia: Delivery vehicle
Multimedia Learning as Knowledge Construction

- Teacher: Information provider (Cognitive guide)
- Learner: Passive recipient (Active sense-maker)
- Content: Information (Knowledge)
- Goal: Add information (Build coherent mental structure)
- Multimedia: Delivery vehicle (Provides cognitive guidance)

Assumptions

- Dual Channels (Dual Coding, Paivio, 1986; Baddeley, 1992)
- Limited Capacity (Cognitive Load, Sweller, 1990; Baddeley, 1992)
- Active Processing (Wittrock, 1989, 1992)

To comprehend, the learner must actively create meaningful relations.
- Relationships among instructional concepts
- Relationships between instructional concepts and the learner's prior knowledge and experience

Active Learning

<table>
<thead>
<tr>
<th>Behavioral Activity</th>
<th>Cognitive Activity</th>
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### Cognitive Science

#### Cognitive Theory of Multimedia Learning

**Select** relevant information from what is presented
- words -> processed in verbal WM (text base)
- images -> processed in visual WM (image base)

**Organize** the pieces of information into a coherent mental representation
- text base -> verbal mental model
- image base -> pictorial mental model
- Associative processing: Associations within visual and within verbal system

**Integrate** the newly constructed representation with others
- Build referential connections between the two representations
- Integrate with mental model

#### Integrated Text & Picture Comprehension Model

- Sensory Registers
- Working Memory
- Long term memory
- Perceptual Level: multiple sensory channels
- Cognitive Level: verbal and pictorial channels

#### Two Basic Forms of Representation:

- Descriptive representations - consist of symbols
  - Relationship to referent based on convention
- Depictive representations - consist of icons
  - Relationship to referent based on perceptual similarity
**Cognitive Science**

### Integrated Text & Picture Comprehension Model

#### Forms of Internal Representation:
- **Verbal:** Text-surface representation  
  - Propositional Model  
  - Descriptive
- **Pictorial:** Perceptual representation  
  - Mental model  
  - Depictive

---

### Integrated Text & Picture Comprehension Model

- Both verbal and pictorial information can enter working memory through different sensory channels
- Both verbal and pictorial information require prior knowledge that is stored in long-term memory

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### Integrated Text & Picture Comprehension Model

- Selection of information
- Organization of information
- Activation of prior knowledge
- Active coherence formation by integration of information from different sources

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### Integrated Text & Picture Comprehension Model

How does this model differ from the Cognitive Theory of Multimedia Learning?

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### Multimedia Learning

- **Media Effects**  
  - Is one medium better than another?
- **Multimedia Effects**  
  - Is multimedia instruction effective?  
  - Single vs. multiple representations
- **Interaction Effects**  
  - For whom is multimedia effective?

(Mayer, 1997)
How can the Cognitive Theory of Multimedia Learning and the Integrated Model of Text & Picture Comprehension be used to inform the design of effective multimedia instruction? Use your own example or one of these scenarios for your answer.

• Introduce medical students to human anatomy.
• Improve freshmen students' Arabic vocabulary and support the process of reading a text in Arabic.
• Train experienced pilots on the instruments of a new type of airplane.
• Introduce the history of the American civil war to high school students.
• Teach college students about molecular structures in organic chemistry.