“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.”
(Clarke, 1983, p. 445)

Overview
- Cognitive Theory of Multimedia Learning
- Application to the Design of Multimedia Instruction

Next Week
- Design Principles for Multimedia
Cognitive Science

Information Processing

Cognitive Science

Delivery Medium

Presentation Mode

Sensory Modality

Multimedia Learning

System used to present instruction (e.g., book-based, computer-based)

Format used to represent the instruction (e.g., words, pictures)

Information processing channel used by learner (e.g., acoustic, visual)

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Class Discussion

What does the multimedia effect predict?
Discuss its implication for the design of multimedia learning environments. Consider:
- the type of learning fostered
- the learning outcomes achieved
- the modalities/presentation modes used

Report a summary of your thoughts to the class.

Metaphors

Multimedia Learning as Information Acquisition
Multimedia Learning as Knowledge Construction

What are the implications of each metaphor for the design of multimedia instruction?

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: Cognitive Guide
- Learner: Active sense maker
- Content: Knowledge
- Goal: Building coherent mental structure
- Multimedia: Provide cognitive guidance

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

Active Learning

<table>
<thead>
<tr>
<th>Behavioral Activity</th>
<th>Cognitive Activity</th>
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Cognitive Science and Educ. Technology I
New York University

Active Learning

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Cognitive Science Assumptions

- Dual Channels (Dual Coding, Paivio, 1986; Baddeley, 1992)
- Limited Capacity (Cognitive Load, Sweller, 1999; Baddeley, 1992)
- Active Processing (Wittrock, 1989)

Cognitive Science

Cogn. Theory of Multimedia Learning

Assumptions

- Dual Channels (Dual Coding, Paivio, 1986; Baddeley, 1992)
- Limited Capacity (Cognitive Load, Sweller, 1999; Baddeley, 1992)
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Prior Knowledge

Integrate

Visual Model (Coherent Visual Mental Representation)

Verbal Model (Coherent Verbal Mental Representation)

Organize Images

Organize Words

Select Images

Select Words

Visual Information

Verbal Information
Cognitive Science

Cognitive Theory of Multimedia Learning

Select relevant information from what is presented
- words -> text base (propositional representation) in WM
- images -> image base (pictorial representation) in WM

Multimedia Learning

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

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

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 be used to inform the design of effective multimedia instruction? Use your own example or one of these scenarios for your answer:

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