

Mayers cognitive theory of multimedia learning



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Mayer describes multimedia as modern presentation modes (text, pictures etc.) and different modalities (visual, auditory etc.) that are presented by an integrated technical system such as computer and internet. According to Mayer, multimedia learning refers to learning from words and pictures and multimedia instruction refers to the presentations of words and pictures. We see that Mayer describes the differences between multimedia learning and multimedia instruction. According to his description, multimedia instruction is the learning material which presents words and pictures that are intended to promote learning whereas multimedia learning refers to the learner constructed knowledge that builds mental representations from these words and pictures; that is, multimedia instruction.

Mayer (2009) states three views of multimedia messages. Multimedia messages can be based on

the delivery media such as amplified speaker and computer screen

presentation modes such as words and pictures, or

sensory modalities such as auditory and visual.

In the first view, it is clearly seen that delivery media is technology centered and focus is on technology rather than learners; that is, the focus is on the devices used to present information rather than on how people learn. The other views are learner centered. These views are consistent with learner centered approach and based on cognitive theory of learning on how people learn. Moreover, these two views are consistent with constructivist learning which is based on actively constructed knowledge rather than passively

transmitted and gathered. The only distinction between these views is the sensory modalities view of multimedia is consistent with a cognitive theory of learning that assumes humans have separate information processing channels for auditory and visual processing whereas presentation modes view is consistent with a cognitive theory of learning that assumes humans have separate information processing channels for verbal and pictorial knowledge.

In the following figure, Mayer (2009) describes his cognitive theory of multimedia learning.

Figure: Cognitive Theory of Multimedia Learning

This cognitive theory of multimedia learning is based on three assumptions (2009):

dual channels: there are separate channels for processing visual and auditory experiences and information in humans' memory

limited capacity: each information channel is limited in its ability to process the amount of information and experiences at one time

active processing: processing experience and information in channels is an active process designed to construct coherent mental representations

According to this model, the learner must engage in the five cognitive processes or steps in order for meaningful learning to occur in multimedia environment. First, learner selects the relevant words for processing in verbal working memory. Then, learner selects relevant images for processing

in visual working memory. After that, learner organizes selected words into a verbal mental model and selected images into a visual mental model. Finally, learner integrates work based and image based representations as well as prior knowledge (Mayer, 2009).

Mayer's cognitive theory of multimedia learning draws on Paivio's (1986) dual coding theory, Sweller's (1988) cognitive load theory, Baddeley's (1992) model of working memory, Mayer's (1996) SOI model of meaningful learning and Bruner's constructivist theory.

The working memory model explains what happens to information after it is perceived by the sense organs and suggests that there are separate slave systems such as phonological loop and visuo-spatial sketch pad for processing visual and verbal information (Baddeley, 1992). Dual coding theory is built on the working memory model and suggests that humans have two separate systems for representing verbal and nonverbal information. This verbal and nonverbal information is processed differently and in separate channels and although these systems are structurally and functionally independent, they are also interconnected (Paivio, 1986). Cognitive load theory points the findings from studies about dual coding theory; for example, information processing system is consist of two independent channels for processing and representing information which are limited in their capacity and suggests that learning happens best under conditions that are aligned with human cognitive architecture. Cognitive load theory is concerned with the way cognitive resources are focused and used during learning and problem solving (Sweller, 1988).

Although Mayer's cognitive theory of multimedia learning draws on many theories, Mayer's multimedia theory is specifically based on Paivio's dual coding theory which basically assumes that humans have separate information processing channels for verbal and pictorial information for auditory and visual messages. According to Mayer's theory, the learner has a visual and verbal information processing system. For example, auditory narration goes into the verbal information processing system whereas animation goes into the visual information processing system. Since dual coding theory is built on the working memory model of Baddeley and working memory includes verbal and visual channels which are phonological loop and visuo-spatial sketch pad for processing visual and verbal information, we can also say that Mayer's theory is consistent with Baddeley's one. Mayer also uses Sweller's cognitive load theory to understand how humans learn and humans' cognitive limitations for processing information. By using cognitive load theory, Mayer suggest that presenting too many elements such as words and pictures in multimedia material can lead to overload to be processed in visual or verbal information processing systems. Mayer also supports the theory of constructivist learning. By considering constructivist learning theory, Mayer suggests that cognitive construction and active learning depends on the cognitive processing of the learner during learning process. For example, learner constructs new knowledge by using active learning methods such as actively and mentally engaged in learning processes although passively sitting in the chair and watching a presentation. Mayer's also use his SOI model of meaningful learning while building cognitive theory of multimedia learning. In this model, learners are again knowledge constructors who pay attention

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to relevant words and pictures in multimedia message in order to produce meaningful learning and organize the information in coherent verbal and pictorial model, and integrate it with prior knowledge.

By his theory, first, Mayer has contributed to establishing a cognitive theory of multimedia learning which builds on how people learn. Mayer's theory also continues to contribute greatly to establishing theories and principles about learning in multimedia environment. Also, his theory and principles are a great resource for instructional designers to consider the cognitive processes related with learning. Instructional designers need to consider the learners and their memory capacities. They need to design their learning materials to maximize the focus on learning activities and minimize the learners' attention to activities which are not directly related to learning. When considering new delivery media technologies such as mobile phones, tablet pcs and smart phones, I think future researches need to be conducted to evaluate the multimedia by using this theory in a real world context or new derivatives of theories need to be developed from Mayer's one to adapt it to recent real life conditions.