Cognitive Theory of Multimedia Learning

General

Cognitive theory of multimedia learning is one of the cognitivist learning theories introduced by an American psychology professor Richard Meyer in 1990s. Basic assumption of his theory is that the **human working memory** has **two sub-components** that **work in parallel** (visual and verbal/acoustic) and that learning can be more successful if both of this channels are used for information processing at the same time.

What is cognitive theory of multimedia learning?

The suggestion that human working memory has more sub-components firstly came from the working memory models designed by A. Baddeley and G. Hitch in 1974. These findings where further incorporated to the Dual coding theory by A. Paivio and later by Mayer and his colleagues.

In his theory Mayer started building his model from the assumption that the **audio and video channels in our working memory are separated** and can be used for processing information simultaneously thus enhancing process of learning (*The Modality principle*). Also, he recognizes that, as Miller's Information processing theory has shown, **these channels have limited capacity**. His third assumption is that learning is an active process of collecting, organizing and integrating new information.

These assumptions lead to the conclusion that, taking into consideration cognitive load, **learning process can be improved** by **providing learning material** to the learner **simultaneously through both channels**. Mayer proved this concepts through conducted experiments[1)].

There are several important **principles of cognitive theory of multimedia learning** identified by Mayer:

- **Modality principle** - applies to the idea that humans have a separated visual/pictorial and auditory/verbal channel for information processing that can work in parallel, but have limited capacity. **Using both channels can enhance learning**.
- **Redundancy principle** - refers to the fact that **capacity of both channels can unnecessarily be overloaded by redundant information** presented through both channels thereby negatively affecting learning process.
- **Spatial contiguity principle** - **information processing is easier when less cognitive effort is needed**. For example, text placed near the referred place in the diagram will result in more successful learning than if it is placed under the diagram. (Example from Mayer's "Multimedia Learning")
- **Temporal contiguity principle** - **simultaneous presentation should be most similar to the way human mind operates** and has provided best experimental results, same as presenting them with very short time differences.
- **Coherence principle** - claims that **extraneous material** that may be interesting or motivating but is irrelevant and generally **wastes learning resources**.
- **Individual differences principle** - emphasizes influence of prior knowledge to results of learning. Design effects are stronger for learners with little prior knowledge, which results in

different optimal instructional design for **intermediate learners or beginners**.

What is the practical meaning of cognitive theory of multimedia learning?

Principles of the cognitive theory of multimedia learning have a rather practical application in educational theory. As stated by Mayer in his book “Media learning”, meaning of the principals (in order they are introduced above) can be described as follows:

- Students learn better from words and pictures than from words alone
- Students learn better from animation and narration together than only from animation or narration or on-screen text
- Students learn better when corresponding words and pictures are presented close rather than far from each other on the page or screen
- Students learn better when corresponding words and pictures are presented simultaneously rather than one after another
- Students learn better when extraneous material is excluded rather than included
- All of this design effects are stronger for low-knowledge learners than for high knowledge learners, and for high-spatial learners rather than for low-spatial learners

Keywords and most important names

- **Cognitive theory of multimedia learning**, **dual coding theory**, **visual and verbal/acoustic channel**, **modality principle**, **redundancy principle**, **spatial contiguity principle**, **temporal contiguity principle**, **coherence principle**, **individual differences principle**
- Richard Mayer

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