Visual Design Impact on Learning

Research & Theories

Cognitive Load

During a learning experience, students' cognitive loads include the load inherent to the complexity of the subject, the cognitive activity of learning, and additional cognitive effort imposed by the experience (including stereotype threat or imposter syndrome). Information collected from the environment in Sensory Memory must be processed by Working Memory in order to be encoded in Long-term Memory. Working Memory (previously called Short-Term Memory) has limited capacity. Cognitive overload can harm learning.

***The Takeaways*:**

- Using both the audio/verbal and the visual/pictorial channel can improve comprehension so long as visual information complements (rather than competes with) what is being discussed.
- Highlight key points and help students learn to identify the most important information.
- Segment information so that students can focus on specific subsets of information at a time.
- Reduce extraneous load by eliminating purely decorative oral or visual components.

Reference:

eJong T (2010). Cognitive load theory, educational research, and instructional design: Some food for thought. Instructional Science 38, 105-134.

Dual Coding

The human mind has two classes or "codes" of mental representation: verbal representations (natural language, inner speech) and mental images. Visual and verbal information are processed differently and along distinct channels in the human mind. Separate representations

for information are processed in each channel. Both codes of representation can be used when recalling information. Although, these systems function independently, they also interact.

The Takeaways:

- Images help with the memory of verbal material because when a word evokes an associated image, two separate memory traces are created--one in each of the memory systems. The chances that a memory will be retained and retrieved are much greater if it is stored in two distinct places rather than in just one.
- Avoid requiring two tasks that require use of the same code of representation. Due to the fact that they are calling on the same resources, they can strongly interfere with each other.

Reference:

Thomas, N. J. T. (2014). Dual Coding and Common Coding Theories of Memory. Retrieved from https://plato.stanford.edu/entries/mental-imagery/theories-memory.html (Links to an external site.)

Emotional Design

Using visual design elements in multimedia learning environments or course materials that affect learner's emotions and foster learning. Research has shown that well-designed materials induced positive emotions and facilitated comprehension. A learner's feeling of difficulty and feeling of confidence during a learning task are related to positive and negative emotions. Positive emotions lower the perceived difficulty of a learning task, inspired students to invest more mental effort during task processing, and also support information and communication processing, negotiation, decision-making, creative problem solving and sorting performance. During the research conducted, students who received well-designed material reported higher motivation, satisfaction, and perception towards the learning material.

The Takeaway:

- Well-designed visual materials, in particular using color and shapes that are connected to positive emotions, affect the meta-cognitive learning experience for your students.
- If you are struggling with student motivation and engagement with a learning task, consider the visual design of the learning environment and how improving it might affect a student's emotions and, in-turn, their attitude towards the learning task.

Reference:

Plass, J., Heidig, S., et al. (2013). Emotional design in multimedia learning: Effect of shape and color on affect and learning. Learning and Instruction 29, (128-140)

Memory Retention

Visual memory is superior to verbal and auditory recall. Studies have found that an image paired with text is 65% more likely to be recalled a three days later than compared with just 10% when only text was used.. The strategic use of color in instructional materials can also increase memory retention as it contributes to a richer learning experience and can cue a learner to important concepts and words. Visual cues when added to instructional material can significantly increase learning and retention.

The Takeaway:

- Relevant images paired with minimal text can significantly increase memory retention.
- Because visual memory is the strongest, it serves us well to provide as many relevant visuals as possible to our course material.
- Use color in strategic places to emphasize important concepts.

References:

Cohen, Michael A., Todd S. Horowitz, and Jeremy M. Wolfe. "Auditory Recognition Memory Is Inferior to Visual Recognition Memory." *Proceedings of the National Academy of Sciences of the United States of America* 106.14 (2009): 6008–6010. *PMC*. Web. 6 Mar. 2017.

Davis, Sandra E. "Learning styles and memory." *Institute for Learning Styles Journal* 1.1 (2007): 46-51.

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