**Literature Review**

**Questions these literature reviews should be answering:**

* What does cognitive load research tell us about how to manage limited attentional resources? [(a bit about about cognitive load)](https://jonyablonski.com/articles/2015/design-principles-for-reducing-cognitive-load/)
* Does memory work the same way for virtual objects as it does for real ones? (If memory for virtual objects is worse than for physical objects, we will have to add more spatial cues to AR applications and design)
* How can we make our AR application in such a way that we can direct the user’s attention towards relevant data and away from irrelevant data?

***Research Paper Reviewing:*** *Mayer, R. E., & Moreno, R. (2003). Nine ways to reduce cognitive load in multimedia learning. Educational Psychologist,*

<https://www.uky.edu/~gmswan3/544/9_ways_to_reduce_CL.pdf>

This literature review is relevant to my individual tasks of analyzing research papers that help answer the following question -> **“What does *cognitive load research* tell us about how to manage limited attentional resources?”**

**Review by Raja**

The Mayer and Moreno (2003) paper does not specifically compare video-based learning to text-based learning or make a claim that one is inherently better than the other. Instead, the paper discusses various strategies for reducing cognitive load in multimedia learning, which refers to the amount of mental effort required to process and understand information presented in multiple modalities (such as text, audio, and video).

The paper presents nine evidence-based strategies for reducing cognitive load in multimedia learning, based on research in cognitive psychology and instructional design. These strategies include:

1. Pre-training: providing prior knowledge or schema to help learners better understand new information.
2. Segmenting: dividing complex material into smaller, more manageable chunks.
3. Signaling: using visual or auditory cues to highlight important information and guide learners' attention.
4. Modality principle: presenting verbal information through audio and visual information through static images.
5. Redundancy principle: avoiding the simultaneous presentation of redundant information in multiple modalities.
6. Coherence principle: organizing material in a logical and meaningful way.
7. Personalization principle: using examples and anecdotes that are relevant and meaningful to learners.
8. Contiguity principle: aligning corresponding words and images in close proximity.
9. Concreteness principle: using concrete rather than abstract examples.

The paper suggests that these strategies can help reduce cognitive load and facilitate learning in multimedia environments, including video-based learning. However, it is important to note that these strategies may not be equally effective in all learning contexts and may need to be tailored to the specific learning goals and learners.

***Research Paper Reviewing:*** *Hwang, G. J., Chen, N. S., & Tsai, C. C. (2014). The effects of collaborative learning with augmented reality on problem-solving ability. Educational Technology & Society,*

**Review by Raja**

The Hwang, Chen, and Tsai (2014) paper presents a study on the use of collaborative learning with augmented reality (AR) to enhance problem-solving ability in a *high school science class.* The study found that students who participated in collaborative learning with AR showed significantly higher scores on a problem-solving test compared to students who participated in traditional collaborative learning or individual learning.

The authors suggest that collaborative learning with AR may be effective in enhancing problem-solving ability because it can provide a more immersive and interactive learning environment that can facilitate the construction of mental models and promote critical thinking and problem-solving skills. In addition, AR can provide real-time feedback and allow learners to manipulate and experiment with virtual objects, which can enhance their understanding of complex concepts and processes.

In summary, the study suggests that collaborative learning with AR can be a useful tool for enhancing learning and problem-solving ability, especially in science education. However, it is important to note that the study was conducted with a small sample size and further research is needed to confirm and expand upon these findings.

***Research Paper Reviewing:***