If you want to teach someone something by making for example a video, an infographic, or a PowerPoint presentation, you're interested in creating educational multimedia. Multimedia is defined as anything that uses both words and images to convey a message. And creating multimedia takes a lot more time and effort than just writing some text. But multimedia has been shown in research studies to lead to better learning than words alone.

So, if you have the time, making multimedia is a great investment in your teaching.

You want to make sure it's a smart investment though, so you want to follow research-based best practices for creating multimedia that is optimized for learning. In this video, we will discuss Mayer's Principles of Multimedia Design, which are guidelines for creating educational multimedia with characteristics shown in research to improve learning.

We'll also take a look at examples of multimedia that follow or ignore these guidelines. By the end of this video, you will be able to determine which of these principles are appropriate to apply to any given piece of multimedia to make it more effective for teaching and learning.

Professor Richard Mayer of UC Santa Barbara has assembled a list of principles of multimedia design from a vast body of educational research. We'll go through these principles and define them, and to illustrate them I'll apply each to a video with the goal of teaching a beginner how to crochet. Video is especially effective at teaching people how to perform a task, but these principles and multimedia in general can and should be applied to any subject from art history to quantum physics to zoology.

First up is the multimedia principle. As we mentioned earlier learning is improved when you add graphics to your words.

For my video teaching how to crochet, it's obvious that a visual of how the hook and yarn move is going to be critical, but other topics that aren't so obviously visual will also benefit from images.

The rest of the principles are more specific. They discuss how to improve learning from your multimedia. Like the Coherence Principle. Learning is improved when you exclude extraneous potentially distracting material from multimedia. For example, remember that the goal of this video is to teach a beginner how to crochet. If I include photos of adorable baby lambs from which the wool to be crocheted might have come, this is violating the Coherence Principle as it is likely to distract the learner from the crocheting process.

Next the Signaling Principle. Learning is improved when you highlight the key content in its organization.

For example, use outlines, headings, highlighting, underlining, voice emphasis, arrows, or flashing.

Going back to our crocheting example, my beginner's crocheting video could start with an outline of the steps of crocheting. Label each step with a heading and draw the learner's attention to tricky maneuvers with an arrow.

The redundancy principle states that learning is improved when you use just graphics and narration together rather than adding on-screen text as well.

The text distracts from the graphics as well as causing verbal overload between

the simultaneous text and narration. Important caveats however are that this does not apply to really short on-screen text or to audio without graphics. In our crocheting example, to optimize learning I should not add the text of the narration to the screen while narrating take a look at this clip which goes against the redundancy principle.

Next pull the new yarn loop at the end of your hook through these other two loops

farther down your hook like this. Did you feel distracted by trying to read the text

and listen and watch the crocheting at the same time? According to the research most people will.

On to the Spatial Contiguity principle. Learning is improved when you place related graphics and text close together on the screen rather than far apart. Here's an example of how it should be done following this guideline. Bring your yarn over the hook towards you and this version does not follow the guideline bring your yarn over the hook towards you.

Now let's talk about the Temporal Contiguity principle. Learning is improved when related graphics and narration occur at the same time rather than one after the other. Take a look at what happens when you separate the narration and the action in our video. First slide your crochet hook into the center of the stitch in the previous row. Then bring your yarn over the hook towards you use the hook to pull this yarn through the stitch below leaving two loops on your hook.

Could you picture what the narration was describing? And then could you remember the description as you watched the action.

It's much easier to process if you play the narration and the actions simultaneously.

Next the Segmenting Principle. Learning is improved when the learner is allowed to advance at their own pace from one short segment to another rather than automatically advancing through all segments in a row. When we implement this in our crocheting video, we can see that this would allow us to process the new information we've learned before proceeding to the next segment.

The pre-training principle states that learning is improved when the learner is introduced to the key elements of a multimedia resource before viewing the resource.

For example, we can provide this list of tools and terms used in crocheting before the learner views our video on how to crochet. The learner is then already familiar with these terms when they watch the video and begin to process the instructions.

Next is the Modality Principle. Learning is improved when a graphic or animation is narrated using audio instead of captioned using text. A caveat is that this may not be true for learners not learning in their first language this crocheting clip with

a text description may be harder to learn from than if it were narrated for example.

Moving on to the Personalization Principle. Learning is improved when language in a multimedia resource is informal and conversational which can make the learner feel more personally connected. For example, we should use this more personalized version of the narrated instructions.

Now you're ready to choose a project. You can find a pattern to buy for just about anything whether you want to make a sweater for your granddaughter, a tea cozy for your aunt, or booties for your dog.

Rather than this more formal version of the instructions.

Now choose a project to complete. Many patterns are commercially available.

The voice principle states that learning is improved when a real human voice narrates multimedia rather than a synthesized computer voice. People don't learn as well from this:

Next pull the new yarn loop at the end of your hook through these two other loops farther down your hook like this.

And last but not least, the Image Principle. Learning is not significantly improved when the narrator's image is shown on screen in addition to the graphics and or text.

Adding my face in the corner like this, as I narrate how to crochet, is distracting.

from the other things viewers should be looking at; however, it is important not to confuse this with a video whose purpose is to increase personal interaction. Showing the professor on screen as they give feedback to the class on an assignment. For example, a short personal message with no graphics has no other visual content for the narrator's image to distract from so the viewer is free to watch the professor's facial expressions as they speak.

And that's it. Now that you're familiar with Mayer's Principles of Multimedia Design

you have the tools you need to make your multimedia more effective for learning.

Give it a try yourself. Take a piece of educational multimedia,

one you've made or perhaps just one you've seen and evaluate it according to each principle.

Does it follow the guideline? If not, what changes could you make so that it does?

Your multimedia and thus your students will benefit from this thoughtful analysis.

If you'd like to know more about the cognitive theory behind Mayer's Principles,

take a look at our companion video on cognitive theory and the multimedia principle.

If you haven't already and for your reference here's the list of research

papers we've cited in this video that support the various principles.

This is not an exhaustive list. You can find much more research on this topic if you care to look.