Best Practices Guide: Video Micro-lectures (v 1.2)

Purpose

This best practice guide exists to fulfill three goals:

1. The first goal is to briefly describe the [essential cognitive components of the learning process](#).
2. Second, this guide presents strategies to [manage cognitive load](#) so as to maximize students' retention and learning.
3. Third, this guide defines what a micro-lecture is and provides recommendations on how to [prepare and record your own micro-lecture](#).

Intended Learning Outcomes

These three goals are aligned with the following learning outcomes:

1. **Recognize** the essential cognitive components of the learning process.
2. **Incorporate** strategies in your micro-lectures to manage cognitive load during presentations.
3. **Create** an effective micro-lecture using the knowledge and strategies outlined in this guide.

Topic 1: The Essential Components of Learning

If your view of learning involves students creating their own mental representation of new knowledge and that they are an *active sense-maker* in the learning process, you may already be familiar with the *knowledge construction* metaphor of learning as presented by Mayer (2005). Within that metaphor of learning, the role of the instructor is to be a *cognitive guide* for students, not just a source of information or behavioral modifier doling out rewards or punishments as students understand or fail to understand what you are teaching.

Furthermore, if you agree that students must be active partners in the learning experience, there are three essential cognitive principles that you need to be aware that enable them to be active in the learning process:
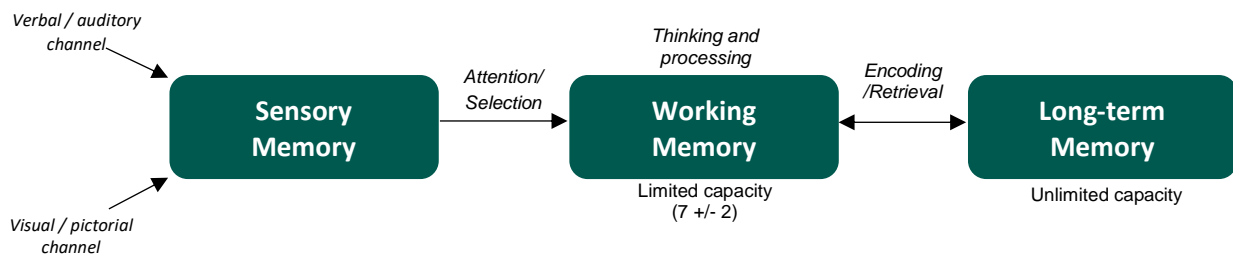
1. Dual channels
2. Limited capacity
3. Active processing

The concept of **dual channels** identifies two channels for processing new information: (1) a channel for processing visual/pictorial material, and (2) a channel for processing auditory/verbal material.

Limited capacity tells us that the processing capacity is limited and that only a few stimuli can be processed by each channel at any one time.

Finally, **active processing** is the moment when students engage in effective cognitive processing during learning to encode new information into long-term memory.

Verbal / auditory channel

Visual / pictorial channel

Sensory Memory

Attention/ Selection

Thinking and processing

Working Memory

Limited capacity (7 +/- 2)

Encoding /Retrieval

Long-term Memory

Unlimited capacity

Cognitive Theory of Multimedia Learning

Figure 1 (above) is a recreation of the Cognitive Theory of Multimedia Learning, as outlined by Mayer (2014c.). When we perceive the world around us, we attune to stimuli through dual channels: a verbal/auditory channel (something we hear) and a visual/pictorial channel (something we see). Anything we see or hear is processed by **sensory memory**. Sensory memory is omnipresent, however, most of what we perceive through sensory memory is almost immediately forgotten, particularly if we deem some particular stimulus as unimportant.

As Clark & Mayer (2016) put it:

> *"Cognitive learning theory explains how mental processes transform information received by the eyes and ears into knowledge and skills in human memory." –*
> *Mayer (2016)*

When we do choose to attune to a particular stimulus, we enter into **working memory**. In their book, *e-Learning and the Science of Instruction*, Clark & Mayer (2016) remind us of the classic expression by Miller (1956): "Seven plus or minus two," which refers to the capacity limit of working memory. In general, humans can only attune to approximately seven stimuli (visual or auditory) at any moment. This is an important fact for instructors; despite best intentions, you may unintentionally overwhelm your students' cognitive capacity if you present too much information all at once. We will discuss strategies to manage cognitive load in the next section.

Learning ultimately occurs when stimuli in working memory (something we attune to) are actively processed by the learning. Once active learning occurs, new information is encoded into **long-term memory**, which has unlimited capacity. Information stored in long-term memory can be recalled at a later time as needed.

Test your understanding

1. What are the three essential components of cognitive processing?
2. How many stimuli can most learners attune to at any given time?
3. Working memory has _____ capacity while long-term memory has _____ capacity.

(*limited / unlimited*)

Topic 2: Strategies to Manage Cognitive Load

As you have just read, cognitive processing is limited when we are learning new information. Typically, we can only attune to 7 +/- 2 forms of stimuli at any given time. Bear in mind, your students may be attuning to stimuli that you are not presenting. Accordingly, an effective course

instructor will take steps to manage their students' cognitive load, to the extent possible when presenting their content.

Demands of cognitive processing capacity

Clark & Mayer (2016) describe three different forms of processing that happen within working memory:

1. Extraneous processing
2. Essential processing
3. Generative processing

Extraneous processing involves any processing capacity that goes towards processing stimuli not associated with the intended content. Some of this happens naturally with learners, such as day-dreaming, getting distracted, not feeling well, etc. However, extraneous processing can also be a side effect of poor design. For our purposes, we want to find ways to limit extraneous processing within any videos you record.

Essential processing is processing that involves learners making meaning of presented information, regardless of its form (e.g., written materials, videos, audio). You should be experiencing essential processing right now as you try to conceptualize the information this guide is presenting. Essential processing will be more or less taxing on cognitive load based on the inherent complexity of the material being presented. For example, a simple algebraic equation will require less essential processing than a complex quantum physics equation.

Generative processing relates to how new knowledge and information is incorporated with previous knowledge. Clark and Mayer refer to this as being a deeper understanding of core material. Not only understanding material presented within itself but how that material relates to other information learners already possess. Instructors who motivate and promote engagement amongst their learners are more likely to promote generative learning.

Strategies to manage cognitive load

For faculty who want to assist their students in managing their cognitive load, here are some strategies to consider which are aligned to various challenges your students may face:

Challenge	Description	Solution	Examples
Too much extraneous processing	The cognitive load caused by extraneous and essential processes exceed mental capacity	Use instructional methods that decrease extraneous processing	• Use audio to describe complex visuals • Write lean text and audio narration
Too much essential processing	The content is so complex that it exceeds cognitive capacity	Use techniques to manage content complexity	• Segment content into smaller chunks • Use pre-training to teach concepts and facts separately

| Insufficient generative processing | The learner does not engage in sufficient processing to result in learning | Incorporate techniques that promote psychological engagement | • Add additional practice activities • Add relevant visuals |

Table 1. Adapted from Clark & Mayer (2016). Approaches to manage cognitive load.

When presenting information to your learners, be mindful that some amount of working memory must be free to make meaning of the information being presented. If you attempt to present too much information to your learners all at once, their cognitive load will be overtaxed and limited or no learning may occur. By presenting your information in small, concise chunks, your students will be better prepared to actually learn the material.

Another set of strategies for managing cognitive load in educational videos is provided by Brame (2015). Brame outlines four recommendations for instructors trying to manage cognitive load amongst their students when presenting educational videos. Those recommendations include:

1. Signaling
2. Segmenting
3. Weeding
4. Matching modality

Brame describes **signaling** as using on-screen text or symbols to identify key information. **Segmenting** involves grouping (or chunking) content into small clusters of similar information; this limits essential processing and gives students greater control of the volume of information they choose to attune to at any one time. Similarly, **weeding** involves minimizing extraneous processing (or what Brame refers to as extraneous load) by removing information from a video that does not relate directly to the primary learning goal. Lastly, Brame discusses the importance of **matching modality**, which involves activating both the verbal/auditory channel and visual/pictorial channel simultaneously.

> *"By using both channels, working memory's capacity is maximized—but either channel can be overwhelmed by high cognitive load. Thus design strategies that manage the cognitive load for both channels in multimedia learning materials promise to enhance learning." - Brame (2015)*

Examples of how to utilize each of these recommendations are listed below.

Process	Effect on Cognitive Load	Examples
Signaling (highlighting important information)	Reduce extraneous processing Enhance generative processing	• Show keywords on screen to highlight important elements • Changes in color/contrast to emphasize how information might be organized
Segmenting (chunking information into smaller groups)	Manage essential processing Enhance generative processing	• Short videos (6 minutes or less) Chapter markers or click-forward assessments embedded in the video
Weeding (eliminating extraneous, unnecessary information)	Reduce extraneous processing	• Eliminate music • Eliminate complex, distracting backgrounds
Matching modality (use both channels complimentarily)	Enhance generative processing	• Use Khan Academy-style videos that illustrate a process or phenomenon • Use narrated animations

Table 2. Adapted from Brame (2015). Strategies to manage cognitive load in instructional videos.

Test your understanding

1. Can you explain the difference between extraneous processing, essential processing, and generative processing?
2. What solutions would you pursue if your students were experience too much extraneous processing? Too much essential processing? Too little generative processing?

Topic 3: Creating An Effective Video Micro-lecture

What is a micro-lecture?

A video micro-lecture, as you might assume, is any recorded video or audio that is intended to help learners understand a particular concept or concepts. One of the principle goals of a micro-lecture is to keep your recorded content short, ideally 3-5 minutes (Fry, n.d.), but certainly no more than 10 minutes. Short, concise video lectures align with the principle of limited capacity, defined above. We understand you may feel apprehensive about creating such a short lecture, but adhering to a few strategies can ensure you create a product that is educationally sound and will help your students learn. As needed, you might break down a larger lecture into smaller micro-lectures; alternatively, you might consider additional learning activities to ensure your students learn key content, such as an online discussion.

Design considerations

If you want to design, record, and share an effective video micro-lectures, you will need to do some pre-planning before you hit record. Of course you want to be mindful of cognitive processing limitations, as outlined above, but there are other steps you will want to take.

First and foremost, you will want to plan out your presentation: what is the topic, how will you explain it to your students, what will you say, and how will you assess your students learning? It is a good idea to write out a script for yourself and to do a run through prior to recording. Again, for a micro-lecture, your topic should be very specific and your recording time should be less than 10 minutes. You wouldn't approach your in-person class lecture without preparing, so take the same approach with an online recorded lecture.

You will also need to identify what software tool you will use to record your micro-lecture. Here are a few options to consider:

- Echo360 guide / Echo 360 video
- PowerPoint
- Zoom

In addition to these recording options, you may also need to consider editing options, hosting options, and sharing options for your videos. A tool like Echo360 is already connected to Canvas, so that is one option.

Once you have outlined your content, created a script, and identified your recording program of choice, you're ready to record. If you're new to recording, you may experience some awkward moments the first few times. That is not unusual and you should avoid getting caught up in seeking a perfect take. There will be some errors, and that's okay, your students will not judge you too harshly for that. Also, be yourself and speak in a conversational tone directly to the camera as much as possible. This will help your learners feel more connected to you and the material you're presenting.

Once you've completed your record, you will want to check it for accessibility. This includes having captions for your video, which many hosting platforms can auto-generate. Two options you might consider are YouTube and MS Stream. If you've already written out your script prior to recording your micro-lecture, you can share that with your students via a PDF file when posting the video.

Finally, rather than simply posting a video for the sake of posting a video, find a way to integrate the video and its content with other aspects of your course. Create a chat or discussion board where students can share their takeaways. Create an assignment or quiz for students to reflect upon what they have learned. This is an excellent method to get students to engage with what you have created. Videos can also be used for a variety of communication forms. You can create a video introduction for your course (and have your students create a video introduction of their own, in turn). You might create a video to explain an assignment, similar to how you would in a physical classroom. You might even create a video to show a process in action, such as a lab experience. Once you start to think about it, the opportunities are nearly limitless.

Test your understanding

1. An effective micro-lecture should be no longer than _____ minutes?
2. If you were creating a video now, do you know what platform you would use to record your video? Do you know how to effectively use that platform?
3. What kind of tone should you use to best connect with your learners?

Additional Resources

Hopefully this guide has helped you to consider micro-lectures as an effective tool to communicate with your students. If you would like additional guidance on creating effective video materials for your course, please consider reviewing the following resources:

Scholarly articles

- Monitoring Indicators of the Flipped Classroom Learning Process based on Data Mining – Taking the Course of "Virtual Reality Technology" as an Example
- Research on Fuzzy Comprehensive Evaluation of Micro-lecture Based on Analytic Hierarchy Process (AHP)

Popular media articles

- 7 Things You Should Know About Microlectures
- Take Your Teaching Online: the Micro-Lecture
- How Do I Create and Implement Microlectures?

Videos

- How to optimize digital micro lectures: Visible Learning & Cognitive Theory of Multimedia Learning (video)
- Micro-lecture on micro-lectures (video)

Other resources

- The Teach Anywhere website
- What is a micro-lecture? (from the University of Illinois at Urbana | Champaign)

References

Brame, C.J. (2015). Effective educational videos. Retrieved April 1, 2020 from http://cft.vanderbilt.edu/guides-sub-pages/effective-educational-videos/.

Clark, R. C., & Mayer, R. E. (2016). How Do People Learn from e-Courses? In *e-Learning and the Science of Instruction: Proven Guidelines for Consumers and Designers of Multimedia Learning* (Fourth, pp. 29–46). Hoboken, NJ: John Wiley & Sons.

Fry, M. R. (n.d.). Best Practices for Using Video in Online Learning. Retrieved April 1, 2020, from https://topkit.org/developing/tools-techniques-strategies/best-practices-for-using-video-in-online-learning/

Grandy, T. (2016, May 17). Take Your Teaching Online: the Micro-Lecture: Inside Higher Ed. Retrieved April 2, 2020, from https://www.insidehighered.com/blogs/gradhacker/take-your-teaching-online-micro-lecture