

# Promoting Critical Reading Through Online Lecture Videos

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Hello everyone. My name is Michael Chen and I am a faculty member in the psychology department. Today we will be talking about online lecture videos and how to create good lecture videos that would promote learning.

## Presentation Outline

1. Brief story
2. Grounding theories
3. Best practices in making lecture videos
4. Two research studies
5. A few research ideas
6. Questions & Comments



Here is my presentation outline. First, I will tell you a little bit about my background and how I got into the research. I would then go over the guiding theories of lecture video design principles. I would then present a list of 16 “best practices” of making lecture videos. In addition, I will describe two research studies related to lecture video design and a few potential research ideas.

# Instructional Designer GA



Some people have a tendency to put every single word they are going to say on their slides to prevent the need to memorize their speech; while this may seem like a good way to get your point across it will only lead to crowded slides that will bore your audience to the point where they are no longer listening to you but in fact they are most likely just reading ahead and waiting for you to hurry up and read faster so they can be dismissed and get on with their daily lives that don't involve the likes of you or your presentation.



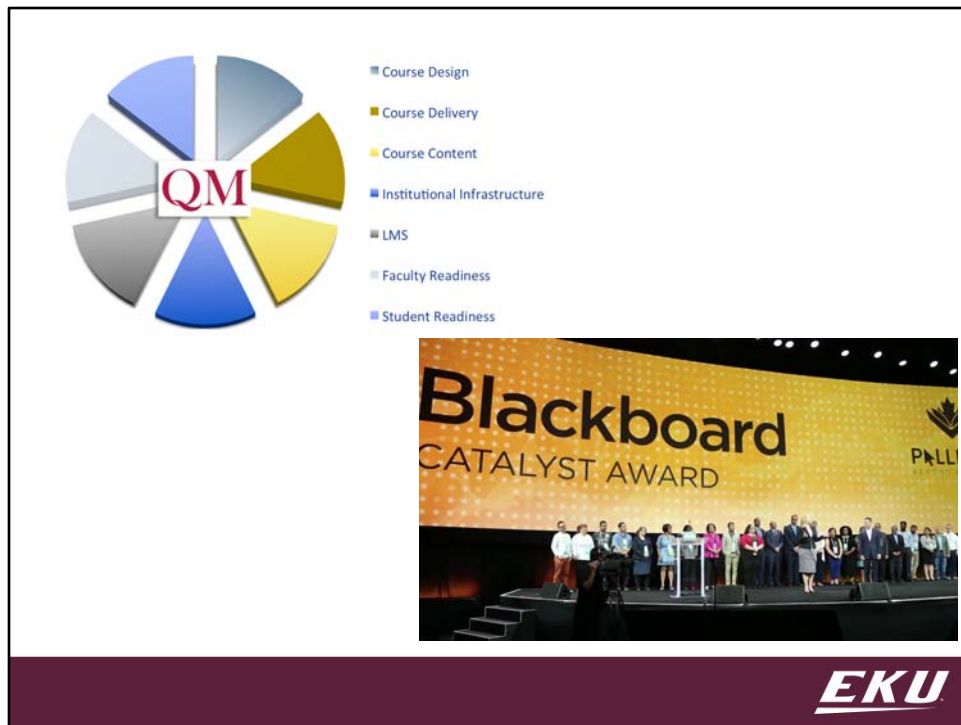
**EKU**

So let me tell you a little bit about my research background. I was a graduate student at UK studying cognitive and human factors principles. I would work as an instructional designer over the summer to make some money.

Working as an instructional designer is interesting, because you get to see content information from a variety of disciplines and you see all types of lectures—you see the good, the bad and the ugly. I had one professor who received a major grant award and contracted a team to create an anti-terrorism game for her geography class. I was just stunned by the amount of work dedicated to a single class.

I also had a professor (an astronomy guy) who would play the guitar and sing in his lecture videos. The actual music was pretty bad, but it worked. Students really liked his sing along astronomy class.

And of course, I had professors who would only put publisher-provided power point slides in their course and that was the end of it. Those classes were the worst.



It was also during my time working as an instructional designer when I learned about standards and awards related to online classes

## Online Course Design Principles

- Backward Design
- Bloom's Taxonomy
- Community of Inquiry Model
- Universal Design for Learning



There are several theories and models that are relevant to the design of an online course. The various design principles have different emphases. Some emphasize the learning process. Others might emphasize community or accessibility.

I am not going to talk about these bigger course design principles in today's talk. If you are interested, you can reach out to the IDC and they provide regular seminars and workshops on these topics.

## Online Lecture Videos

1. Target audience
2. Objective
3. How to record it?
4. Length?
5. Quality?
6. Frequency?
7. Slides or hand-drawn?
8. Rehearsed or unrehearsed?
9. Show face?
10. Classroom capture or dedicated recording?

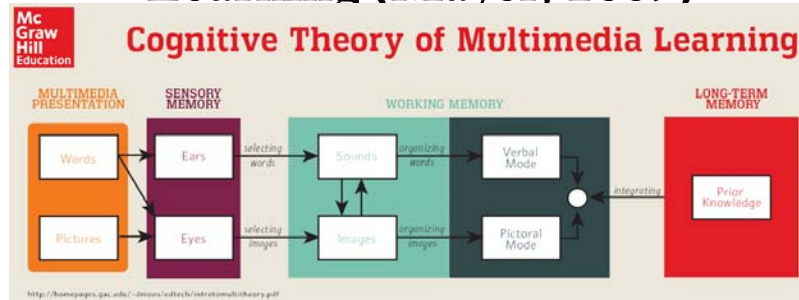


Today, we are going to focus primarily on the design of lecture videos in an online class. Let's say you have decided that you want to incorporate lecture videos in your online class. The natural question that follows is, how exactly should you create these lecture videos to maximize student engagement and learning?

How long should your video be? Should you record a 50-minute lecture like an in-person class? Do you need a studio or is your work computer good enough? Are you going to show your face in these lecture videos?

Hopefully by the end of this talk, you will walk away with some ideas on how to create lecture videos that would maximize learning.

# Cognitive Theory of Multimedia Learning (Mayer, 2009)



1. Dual-channels principle (Paivio, 1986).
2. Limited-capacity principle (Baddeley, 1999; Sweller, Ayres & Kalyuga, 2011).
3. Active processing principle (Mayer, 2009).

**EKU**

When it comes to designing online lecture videos, Richard Mayer is probably the name that you want to remember. His Cognitive Theory of Multimedia Learning guides the best practices of lecture video design. We can talk a lot about this theory. For the purpose of this talk, I want you to focus on three aspects of this theory.

First, a lecture video engages both the audio information channel and the visual information channel of the learner. Sometimes we focus so much on the visual and we neglect the audio part of the presentation. Second, human beings have limited cognitive processing capacities. If you overload your students with too much information all at once, your students wouldn't be able to absorb all that information. Third, learning is an active and effortful process. The more students engage in active and effortful learning, the better they will learn.

1. Dual-channels principle: people have separate information processing channels for visual and verbal information (Paivio, 1986).
2. Limited-capacity principle: people can only process a few elements in working memory at any one time (Baddeley, 1999; Sweller, Ayres & Kalyuga, 2011).
3. Active processing principle: meaningful learning occurs when people engage

in appropriate processing (Mayer, 2009).

## Best Practices

- Reference the handout provided



So keeping the Cognitive Theory of Multimedia Learning and the three main aspects I have mentioned in mind, let's talk about a few concrete DOs and DON'Ts. You can reference the handout that I have provided for you. Most of these best practices are directly derived from a meta-analysis paper by Mayer, but I also reference my own research and the research of a few other people.

So let's get started here

## Best Practice 1: Keep the content focused



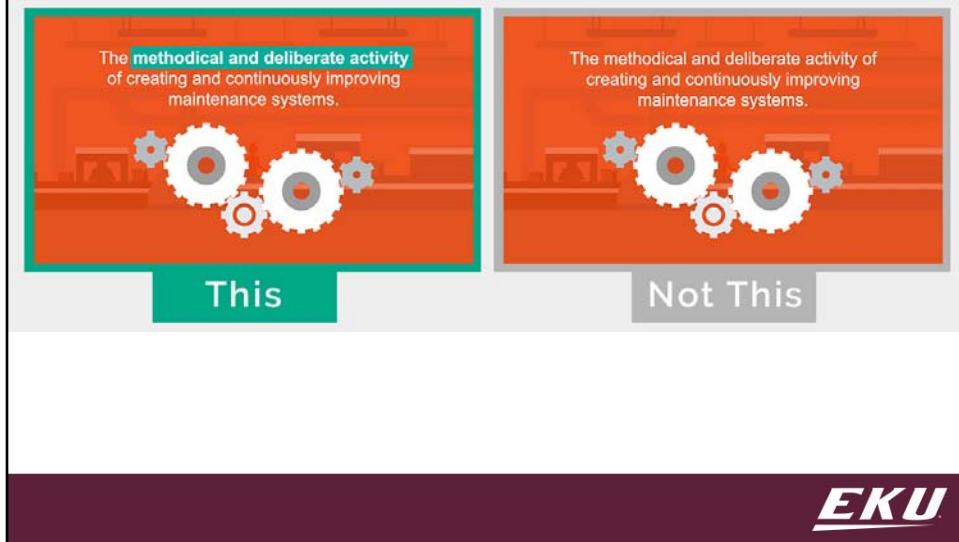
**EKU**

#1: you want to keep the content of your lecture focused. Sometimes we might be tempted to adopt a Youtube or Hollywood style of lecture, with lots of flashy animations or clickable items flying around the screen. You don't want to do that because you are essentially overloading and overworking your students' brain.

Case-in-point. I once watched a lecture of a neuroscience professor on the topic of neurotransmitters. The lecture was really awesome in the sense that the professor weaved a personal story about his fascination with punk rock music, and an unfortunate bathroom accident and tied those with neurotransmitters. The unfortunate thing is that I still remember his story and the bathroom jokes. I cannot remember what neurotransmitter he was talking about.

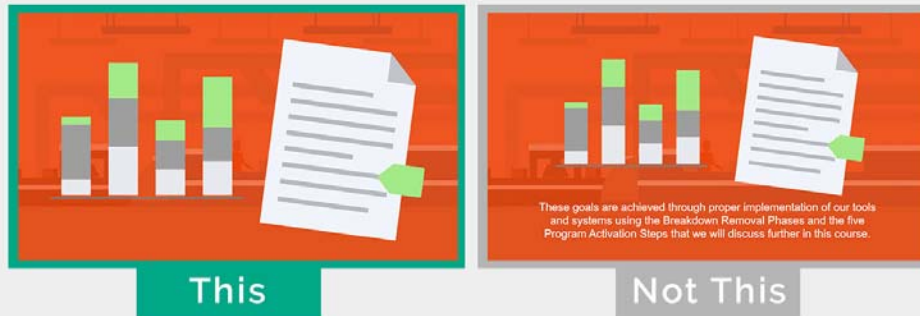
So keep your message focused.

## Best Practice 2: Use Signals



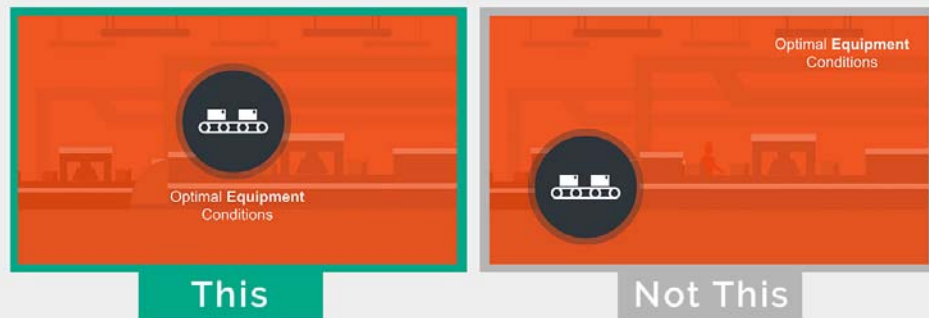
#2. Use signals such as text highlights to help your students quickly focus on the most important content. Highlighting is a way to reduce cognitive load and helps students focus on the most important message of your video.

## Best Practice 3: More graphics and less text (when there is narration)



#3. You don't want to read the slide, because people often just focus on the video input instead of the redundant audio input. Instead, your visual and audio input information should be complimentary and not redundant of each other. In other words, don't put an entire paragraph on the screen and read the screen. Instead, use images to compliment the audio information.

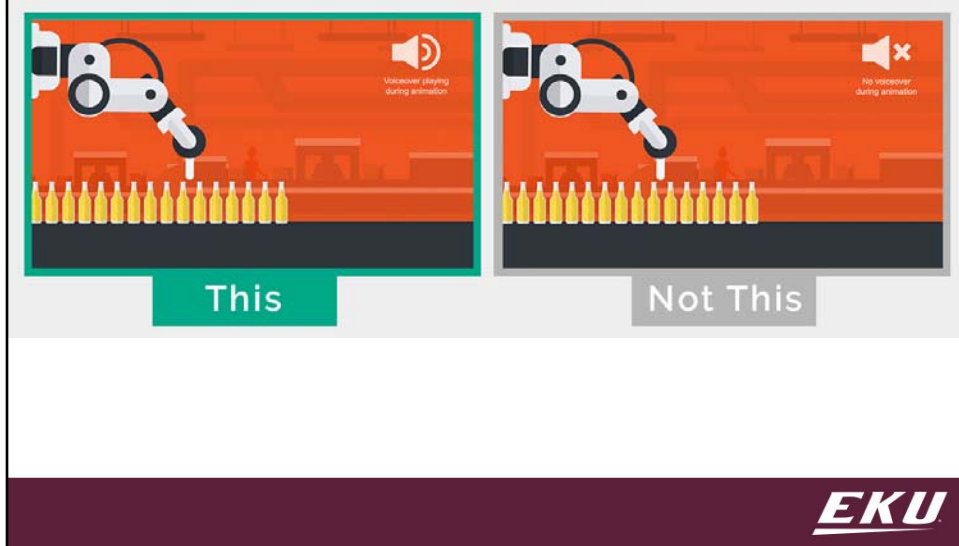
## Best Practice 4: Maintain spatial contiguity



**EKU**

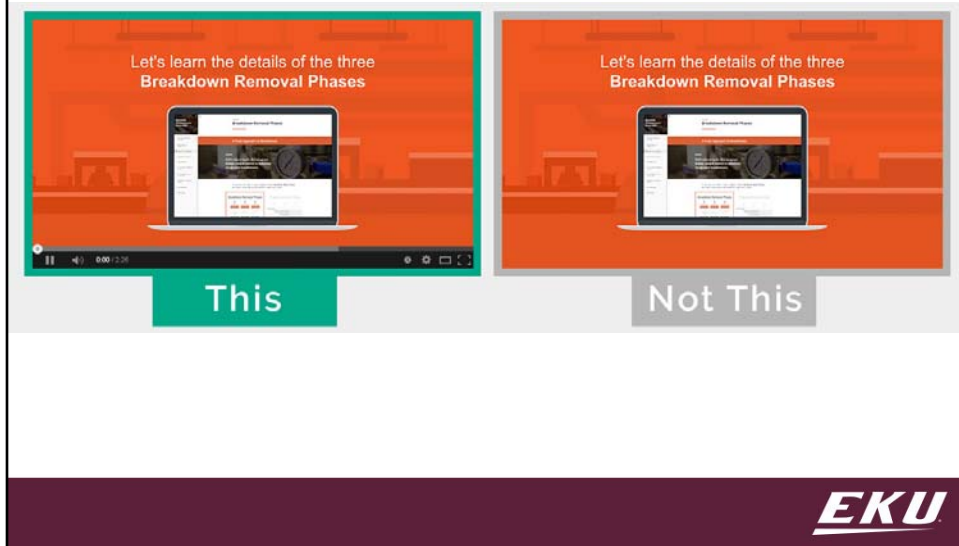
#4, you want to put related information in close proximity. Our eyes tend to group objects on the screen so you want to leverage this natural tendency to your advantage. Sometimes the slide looks better with spacing, but try to prioritize grouping over aesthetics.

## Best Practice 5: Maintain temporal contiguity



#5 maintain temporal contiguity. Relevant information coming from the visual and audio channels should occur at the same time. Sometimes we have the tendency of wanting to put lots of information on the same slide. The visual would thus outpace the audio narration, and your audience would have the tendency to want to skip ahead with their eyes and tune off your audio narration.

## Best Practice 6: Segment longer videos



#6 Segment your videos. You can have a 50-minute lecture, but you want to chunk the lecture into 6-8 minute chunks and intersperse quizzes or response activities. Students have limited cognitive resources and attention span, so overloading their brains with information for 50 minutes is not a good idea. This is the difference between a lecture video and an entertainment video. A person could stay entertained for over 50 minutes. Most of the undergraduate students cannot stay engaged on a learning task for that long.

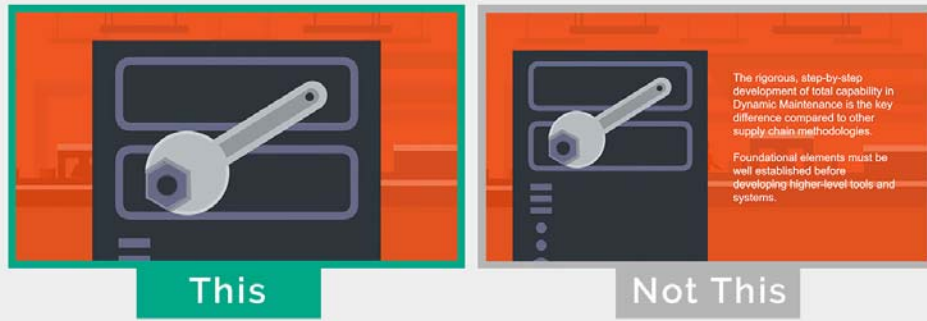
## Best Practice 7: Provide a framework



**EKU**

#7 If your lecture is about a complex or new idea, it is better to provide students with an introductory framework. Having some sort of basic background knowledge helps students to more actively acquire the new information.

## Best Practice 8: Prioritize narration over long on-screen text



**EKU**

#8 If you have a choice between explaining an image or graph via on-screen text or narration, you should go with narration. Again, you want to maximize the complimentary effects of dual-channel processing and not introduce redundant and competing information between the two information channels

# Intermission

Questions?



I want to pause here and allow for a time for questions from the audience. Does anyone have any questions up to this point?

## Best Practice 9: Be personal and speak naturally



This



Not This

**EKU**

#9. When you are recording a lecture video, try to speak naturally as if you were talking to a friend. Try to avoid speaking like you were giving a speech in an auditorium. This can be hard for me, because I have the tendency to get overly enthusiastic about my lecture videos. Because most lecture videos will be consumed in an isolated, individual setting, try to mimic that sort of one-on-one conversation style and tone. This sort of tone also elicit social reciprocity from your student viewer and could motivate them to be more actively engaged with your lecture video.

## Best Practice 10: Create your videos with online students in mind



This



Not This

**EKU**

#10. You want to create your videos with online students in mind. A lecture capture of a live class does not work as well as a specially recorded video. Again, this is related to the human tendency of social and emotional reciprocity. If you feel like you are just one of the many faces in the room that is being talked at, you show lower engagement than if the person is talking directly to you like a friend.

## Best Practice 11: Gesture and Point



This



Not This

**EKU**

#11 If you use a board or drawing in your lecture, gesture and point to the most relevant items. This is similar to the principle of highlighting where you are reducing students' cognitive load and helping them focus on the most important ideas.

## Best Practice 12: Show your face

The image shows two side-by-side presentation slides. Both slides have a title 'Step 2: Write down what you just did' and a list of steps for N = 3. The left slide features a woman's face, while the right slide does not. Below the slides are two labels: 'This' and 'Not This'. The 'This' label is on a green background, and the 'Not This' label is on a grey background. The ECU logo is in the bottom right corner.

**Step 2: Write down what you just did**

Steps for  $N = 3$ :

- Put a blue square at (0,0)
- Put a red square at (0,1)
- Put a red square at (0,2)
- Put a blue square at (0,3)
- Put a red square at (1,1)

**This**

**Not This**

**ECU**

#12. You want to show your face. Seeing the instructor's face promotes social reciprocity and motivate students to learn more actively.

## Best Practice 13: Simple and personal



This



Not This

**EKU**

#13. Keeping things simple and personal is just as good as studio production. The research seems to indicate that there is no significant engagement difference between a home-made lecture video with standard recording equipment versus a professional-grade studio produced lecture video.

## Best Practice 14: Speak with enthusiasm



This



Not This

**EKU**

#14. You want to speak in an informal but enthusiastic tone, promoting that sense of one-on-one dialogue. Again, I think the point is that you want to mimic this one-on-one friendly conversation.

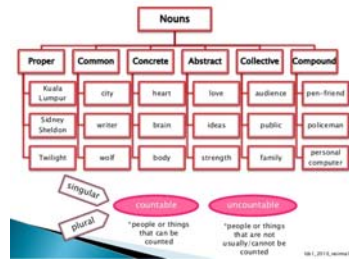
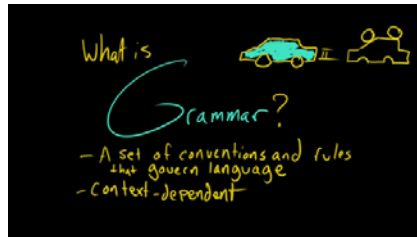
## **Do you need to implement all best practices?**

- The issue of ROI (return of investment)



So far, we have talked about 14 best practices. Is it possible to implement all of these best practices into your lecture videos? Yes, I think the answer is yes. The problem that you would run into is time and effort. Some of the best practices might not fit your teaching style very well. You might have to spend tremendous effort just to implement something that has minimal effect on students' learning.

## Best Practice 15: Draw on the screen



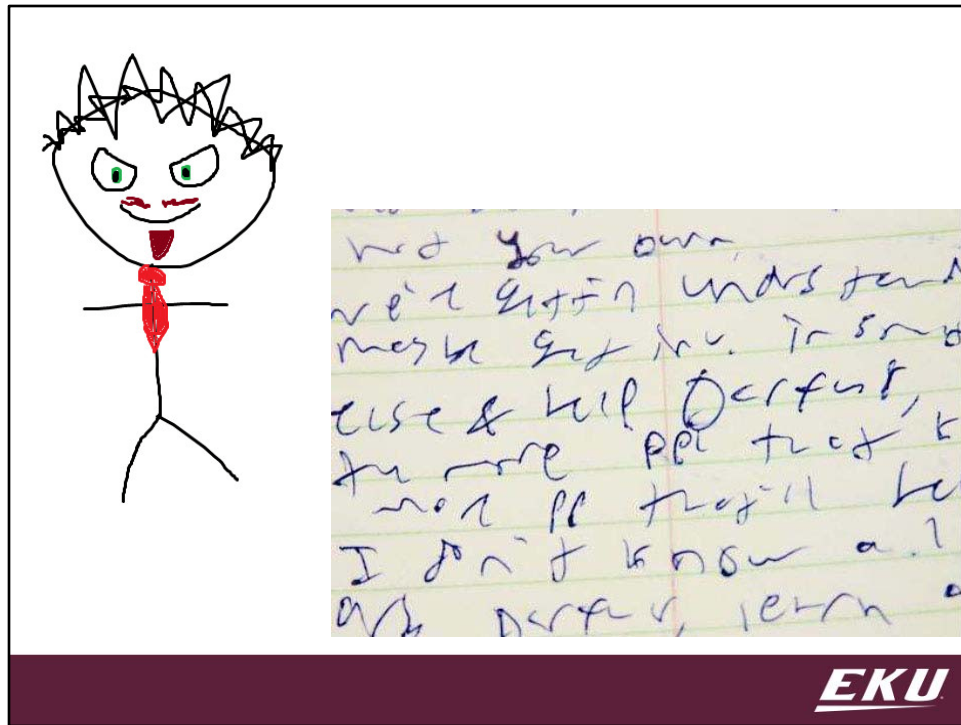
This

Not This

**EKU**

Here is an example of a best practice that I struggle with. Previous research findings indicate that students are much more engaged with a Khan Academy style of hand-drawn lecture videos than a Power Point slide type of narration video.

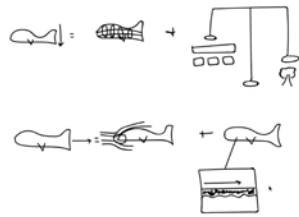
This is a problem for me, because I have horrific drawing and handwriting.



It would take me quite a bit of effort to produce good Khan Academy style lecture videos.

But I was also wondering about something. From a visual perception standpoint, it makes sense that a video with constant hand-drawing motion would be more appealing and engaging to the students. But does that visual appeal translate to actual learning gains?

## Study 1: Drawing vs. Slides (Chen & Thomas, 2020)



1. Hand-drawn continuous video (Khan academy style)

2. Slides with a few transitions (Power Point lecture)

3. Single still slide

**EKU**

So my graduate student and I set out to investigate this issue. And yes, I guess I was subconscious trying to find a justification for not having to create Khan Academy style videos.

So we put participants into three conditions. In the first condition, participants watched a lecture narration with steady and constant hand-drawing motion.

## Study 1: Drawing vs. Slides (Chen & Thomas, 2020)

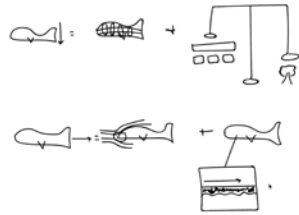


1. Hand-drawn  
continuous video  
(Khan academy style)
2. **Slides with a few  
transitions (Power  
Point lecture)**
3. Single still slide

**EKU**

In the second condition, the various sub-part of the diagram appeared sequentially, along with the audio narration.

## Study 1: Drawing vs. Slides (Chen & Thomas, 2020)



1. Hand-drawn  
continuous video  
(Khan academy style)

2. Slides with a few  
transitions (Power  
Point lecture)

3. **Single still slide**

**EKU**

In the third condition, participants saw the entire diagram as a single still slide with no motion. Participants heard the same audio narration in all three conditions.

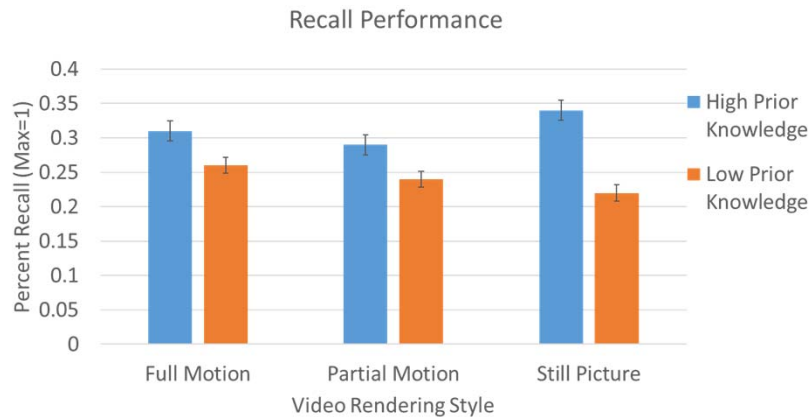
## Study 1: Engagement Ratings

	Full Motion	Partial Motion	Still Picture	Effect Size (Partial $\eta^2$ )
<b>Engagement Rating**</b>	4.95	4.52	4.44	<b>0.05</b>
Concentration**	4.92	4.62	4.56	0.02
Thoughts Only**	4.71	4.34	4.27	0.03
Better Understand*	5.34	5.13	5.12	0.01
Audio Sufficient*	5.12	4.95	4.89	0.01
Unaware Space*	4.39	4.16	4.07	0.01
<b>Video Unnecessary**</b>	2.73	2.82	3.29	<b>0.05</b>
<b>Interesting**</b>	4.52	4.18	4.11	<b>0.04</b>
Clarity	5.45	5.3	5.33	0.01
Good pace	5.19	5.17	5.07	0
Pace too slow	3.12	3.3	3.28	0.01
*p<0.05, **p<0.01				



And what we found was that, student participants overwhelmingly preferred the hand-drawn lecture video. They rated the hand-drawn lecture video as more engaging, helped them understand the content material, and was more interesting.

## Study 1: Recall Performance

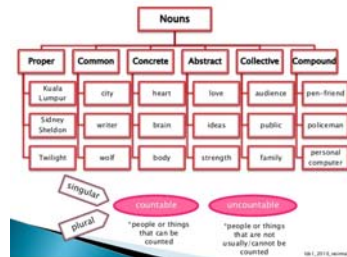
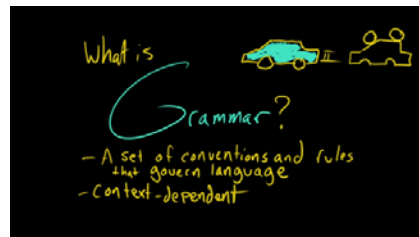


**EKU**

But here comes the interesting part. When it comes to recalling the content information, the students with high prior knowledge performed similarly regardless of the video style. The students with low prior knowledge do benefit from the hand-drawn video, but the performance gain was minimal.

More importantly, if the video had just some motion, almost like power point slide transitions, then there is no significant recall performance difference.

## Best Practice 15: Draw on the screen



This

Not This

**EKU**

So do I draw on the screen? Yes, I do, but only with topics that are difficult, and I know that most students would struggle with. Otherwise, I just use Power Point slides with a few animation and transition.

If you are very artistic and have great hand-writing, you might want to consider the free-hand drawing type of lecture videos, because students really like the style with constant drawing motion. If you are like me, I would recommend that you just incorporate more motion into your Power Point slides.

## **Do you need to implement all best practices?**

- The issue of likeability/engagement vs. long-term retention



And I think the issue that I had discussed with my research is not unique. Many of the “best practice” recommendations seem to err on the side of student engagement, and just assume that increased engagement would automatically translate to better learning. And I think that we are starting to discover that this is not necessarily the case.

## Best Practice 16: Don't use computer generated voices...(?)



This



Not This

**EKU**

Here is another “best practice” recommendation based on student participants’ engagement rating. Students overwhelmingly prefer human voice with a standard Midwest accent than an accented voice or robotic voice.

And this makes intuitive sense. Psychologically speaking, most people prefer human-sounding and familiar voice. People have lower preference for voices that sound foreign or non-human.

## Best Practice 16: Don't worry too much about accents or voices



This



This

**EKU**

But here is the question. We know that people prefer standard Midwest human voice, because it is most familiar and consequently requires the least processing effort. Accented and robotic voices require more effort.

If you have been following the growing trend in learning science, you will know that there is a growing push to get students to exert more effort in the classroom. Ideas such as active learning, flipped classroom, and high impact practices are all taking off. And all of these ideas stem from the simple concept that the more cognitive effort you exert, the more likely are you to retain the information.

## Study 2: Voice Comparison (Morris & Chen, *in press*)



1. Classic computer voice from the 80s

**EKU**

So my student and I conducted another study. In this study, we put participants through three audio lectures. The first lecture utilized one of those computer voices from the 80s. It is very robotic, scratchy, and flat..

## Study 2: Voice Comparison (Morris & Chen, *in press*)



1. Classic computer voice from the 80s



2. Modern computer voice (Siri & Alexa)

**EKU**

The second lecture utilized a modern computer voice that sounds very much like Siri and Alexa. The modern voice sounds much more human-like.

## Study 2: Voice Comparison (Morris & Chen, *in press*)



1. Classic computer voice from the 80s



2. Modern computer voice (Siri & Alexa)



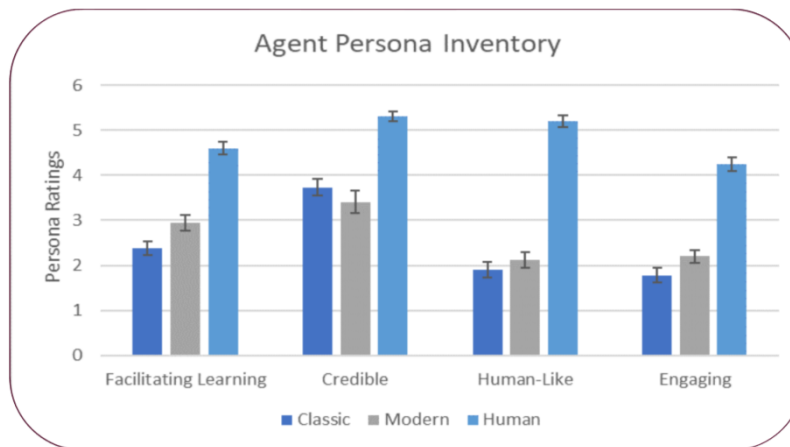
3. Human voice (Midwest accent)

**EKU**

The third lecture utilized a human voice recording with a standard Midwest accent. Or as Midwest as we could get at ECU.

All three voice lectures talked about the same content information, and no visual information was provided for the participants.

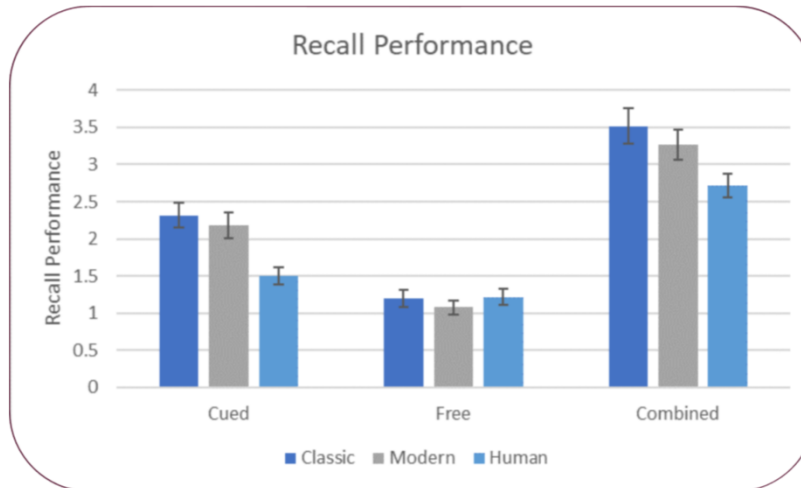
## Study 2: Likeability Ratings



**EKU**

And we found that unsurprisingly, participants very strongly preferred the human voice in all categories. They found the human voice to be more engaging, credible, and facilitated their learning. Participants did not like the modern computer voice much better than the classic computer voice, even though the modern computer voice sounded much more natural.

## Study 2: Recall Performance



**EKU**

And the interesting thing was that when it came to actual information recall, participants had the best overall recall from listening to the old robotic computer voice. Participants had the worst recall performance in the human voice condition.

And herein lies the tension—sometimes chasing after students' preference, good course evaluations, or good "RateMyProfessor" rating is actually detrimental to students' long-term learning.



And as instructors, we need to find that right balance. You want to engage your students and keep them motivated, but you don't want to focus too much on likeability ratings and forgo the fact that the more work students do, the better they learn.

## Looking to future research ideas

1. Engagement vs. Learning
2. Recall vs. Transfer
3. ROI
4. Fishy best practices



**EKU**

If you are interested in pedagogy-related studies, here are a few recommendations that I have.

First, you could take this idea of “balance” and look at the tension between engagement and learning gains. Most studies emphasize one over the other, and studies that look at both ideas simultaneously are refreshing.

Second, many studies still use recall to gauge learning. I think it is time that we move away from that and focus more on students’ ability to translate that knowledge into novel situations. Of course, this is not easy to do.

Third, a lot of studies focus just on students, but ignore the effort that instructors that need to put in. Research studies that look at both student learning and instructor effort are also refreshing.

Fourth, if you see any “best practice” recommendation that might sound fishy, just dig into it more. No pedagogical recommendation is perfect and there are always more ideas waiting for us to explore.

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And that is it for this presentation

# Questions?

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Does anyone have any questions?