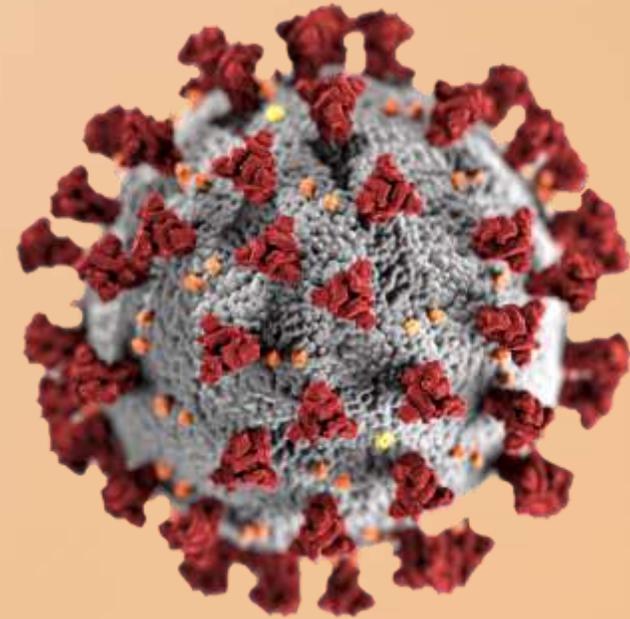# Online Instructors' Use of the Cognitive Theory of Multimedia Learning Design Principles: A Mixed Methods Investigation

WCU Virtual Research and Creative Activity Day
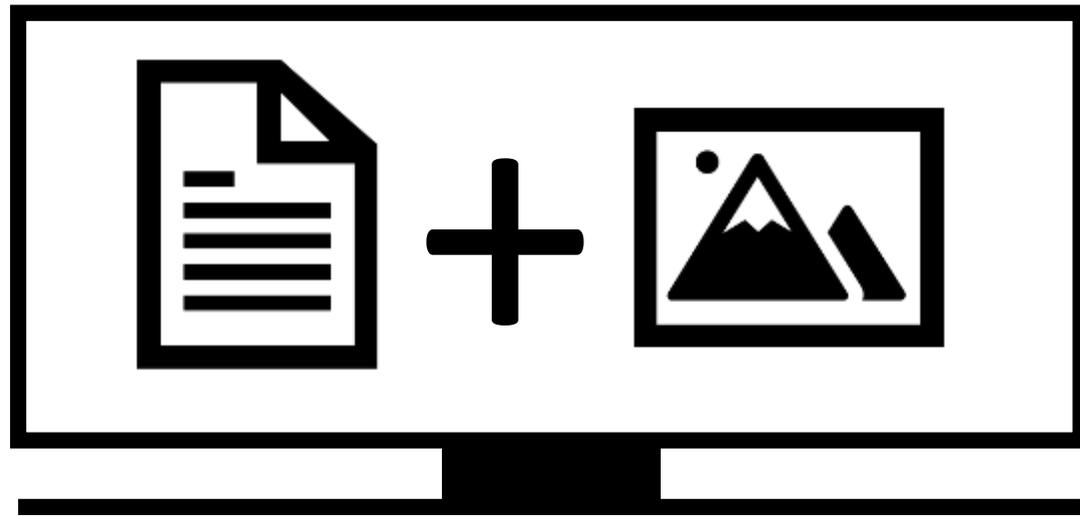
April 29, 2021

Thomas Pantazes, Ed.D.

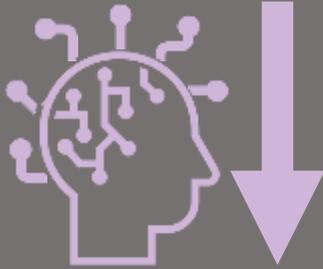# Cognitive Theory of Multimedia Learning

CTML Design Principles

Extraneous Cognitive Load

Essential Cognitive Load

Germane Cognitive Load

CTML Design Principles

Problem Statement

Investigations of digital instructional video at an early stage (Chorianopoulos, 2018).

Focused on students and not instructors (Kay, 2012; Pan et al. 2012)

More research is needed on how faculty learn to implement technologies like digital video into their instruction (Belt & Lowenthal, 2020)

Research Questions

To what extent are higher education instructors who create digital instructional video for online learning applying the 11 multimedia design principles of the Cognitive Theory of Multimedia Learning?

1. Which Cognitive Theory of Multimedia Learning design principles are higher education online instructors incorporating into self-made digital instructional videos? (*quantitative*)

2. Why do higher education online instructors choose components of digital instructional video production to focus on when creating digital video for use in online courses? (*qualitative*)

3. Which CTML design principles appear in higher education online instructors self-selected "best" self-made instructional video? (*quantitative and qualitative*)

4. To what extent are CTML design principles an area of focus for higher education online instructors as they create digital instructional video? (*quantitative and qualitative*)

Phase 1: Quantitative

Survey - 3 weeks

1. Identified 138 instructors
2. Surveyed for 3 weeks

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3. Calculated descriptive statistics
4. Calculated CTML implementation scores
5. Identified highest and lowest scoring design principles
6. Adjusted interview questions

Phase 2: Qualitative

Interviews - 4 weeks

1. Used CTML scores to identify 5 instructors for interviews
2. Conducted interviews over four weeks
3. Generated transcript
4. Sent transcript for a member check
5. Completed reflective self memo

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6. Hypothesis coded transcript
7. *In vivo* coded transcript

Video artifacts - 2 weeks

1. Collected video artifact from each instructor

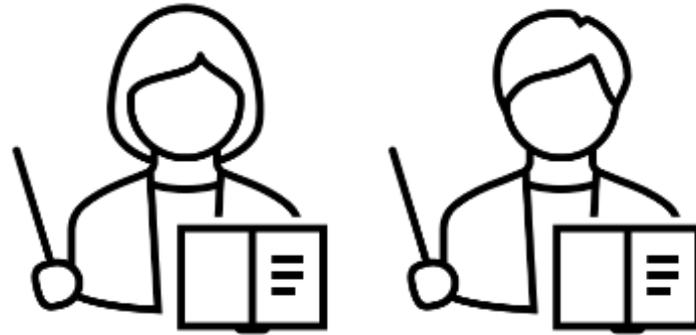2. Hypothesis coded each video

Phase 3: Integration

4 weeks

1. Conducted pattern matching across three data sets
2. Wrote quantitative report
3. Wrote qualitative report

Setting and Sample

Public University

900 Instructors

140 Teaching Online

Instructor Profile

39.86%

response rate

(55/138)

College	# Instructors
Business	15
Humanities	7
Social Work & Education	9
Health Sciences	14
Sciences	7
Other	3

94.6%

Interest	Frequency
Strongly interested	36
Somewhat interested	16
Neutral	1
Somewhat uninterested	2
Total	55

Digital Video Use

88.55% of online courses used video (116/131)

average number of videos per course was

23.13

14.04
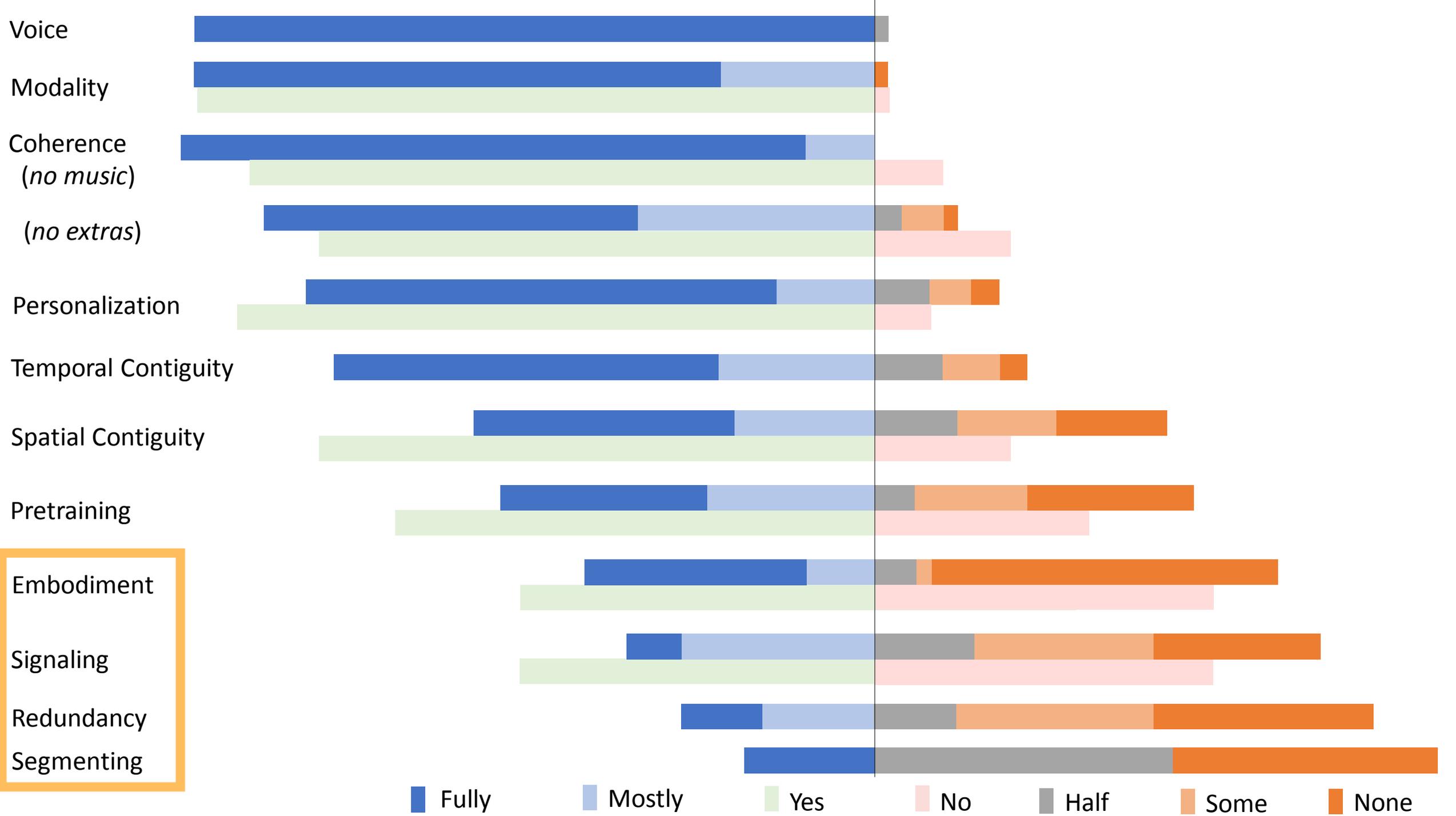
9.47

videos made by the instructor

videos made by others

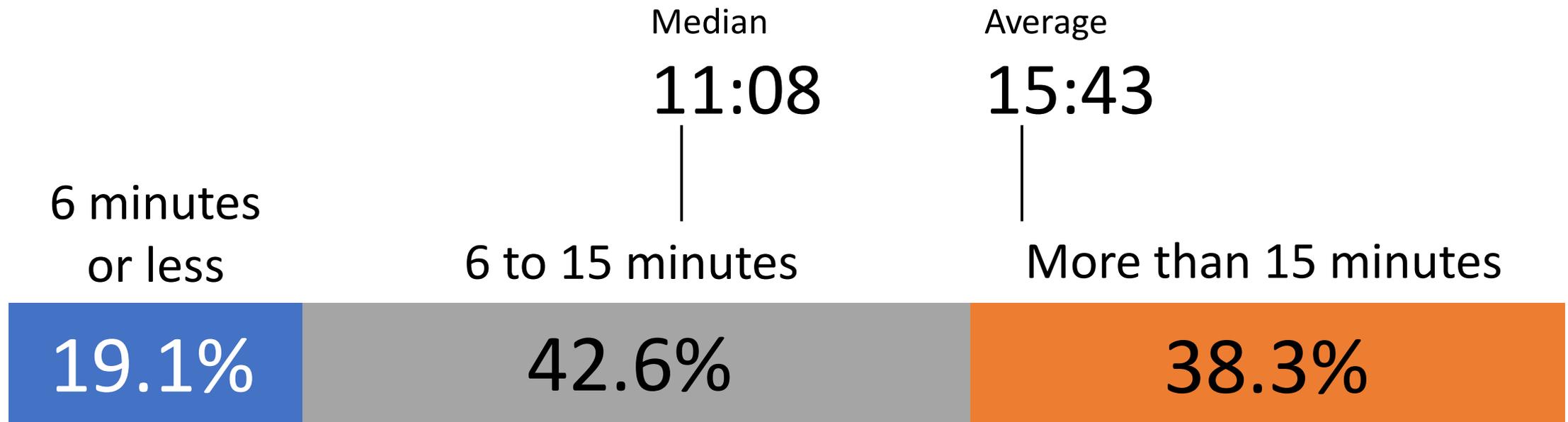**10.2%** of instructors not creating video during semester
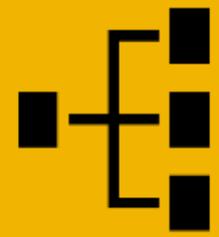
1. Which CTML design principles are instructors incorporating into the videos they create?

	Simple CTML Scale (0 – 12)	Complex CTML Scale (11 - 55)
Average Score	7.0408	39
Median	7	39
Mode	8	36
Minimum	4	39
Maximum	10	47
Application	**58.7%**	**70.9%**

strong correlation between the scales of .728, $p < 0.01$

Voice
Modality
Coherence (*no music*)
(*no extras*)
Personalization
Temporal Contiguity
Spatial Contiguity
Pretraining
Embodiment
Signaling
Redundancy
Segmenting

Fully · Mostly · Yes · No · Half · Some · None

Segmenting

Median
11:08

Average
15:43

6 minutes
or less

6 to 15 minutes

More than 15 minutes

| 19.1% | 42.6% | 38.3% |

Redundancy

🗣️ or 🖥️

55% = Yikes!

Frequency axis: 0, 2, 4, 6, 8, 10, 12

| 0% | 10% | 20% | 30% | 50% | 60% | 70% | 80% | 90% | 100% |

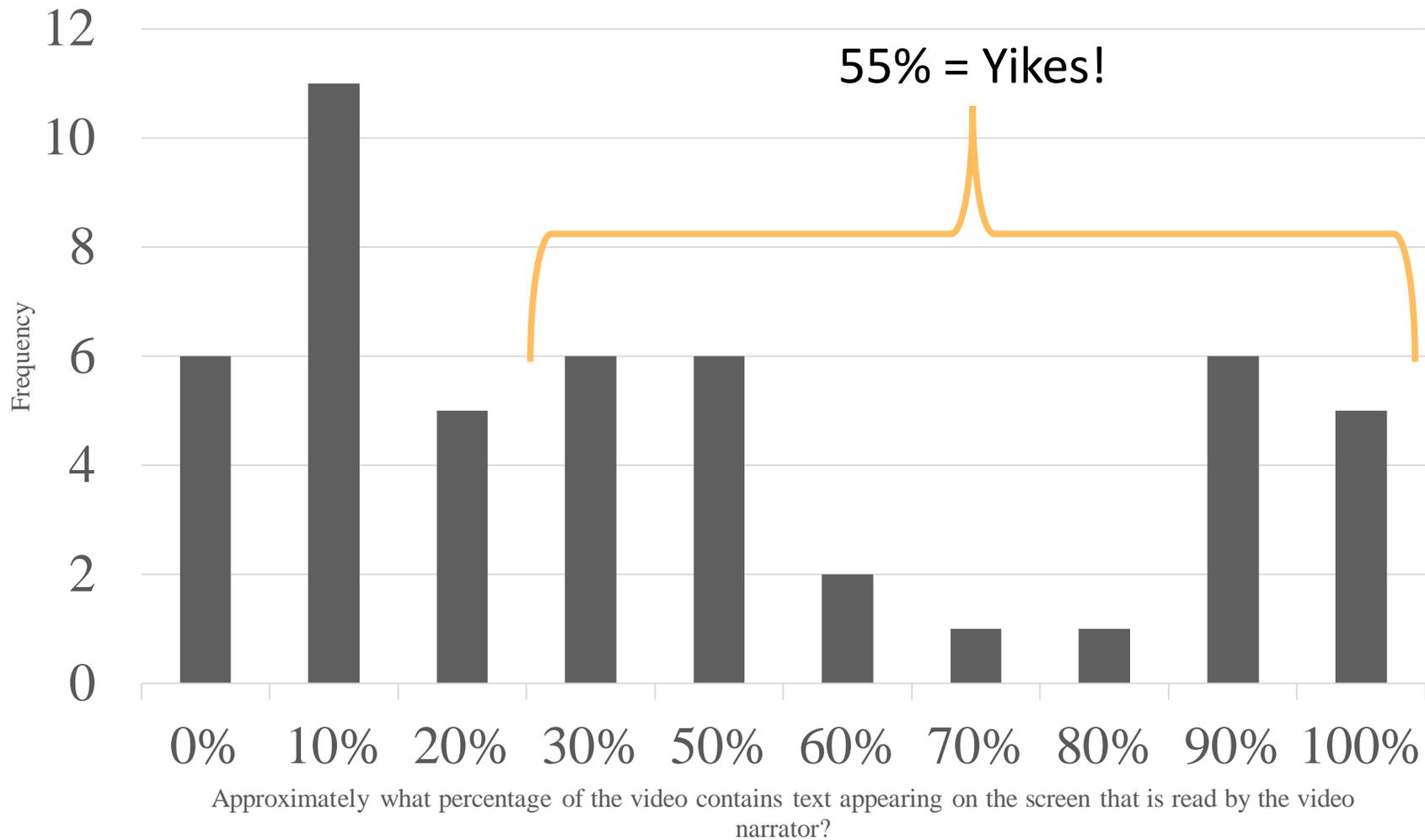Approximately what percentage of the video contains text appearing on the screen that is read by the video narrator?

1 Visual Design informs Principle Application

2 Instructors may improve with experience

3 Desire to signal may be causing more redundant reading

Video Creation

1:48

Camtasia
43.75%

Kaltura
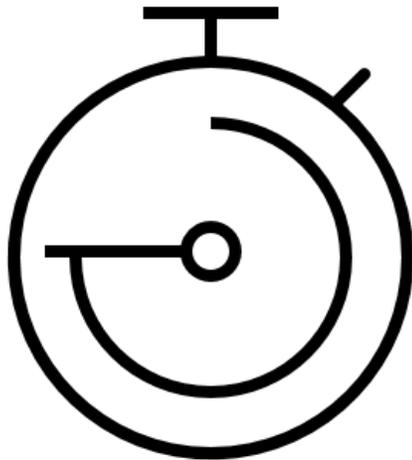29.17%

Zoom
22.92%

PowerPoint
12.5%

Lecture Style 76.32%

Video Creation Process

"I'm also aware that I have to get this done in a short period of time."

"It is so much work."

~Kristine

"Anytime I'm somewhere in the real world and I go, a lightbulb comes on that I teach this. I'm pulling out my cell phone. I'm recording the quick video."
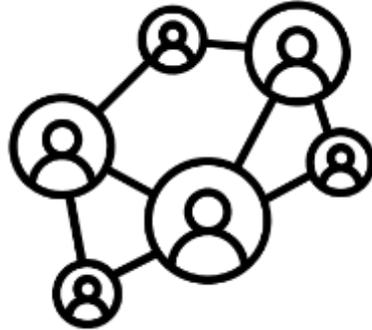
~George

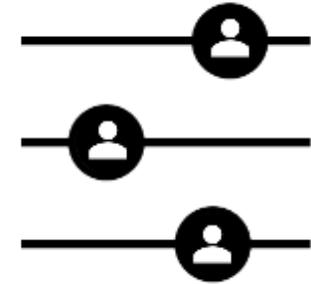# 2. Why do instructors choose components of video production to focus on when creating video?

Visualizing Students to Meet their Needs
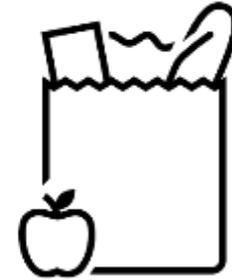
Creating connection with students

Respecting students

Changing because of student feedback

Interviewee Application

Voice

Modality

Coherence
(*no music*)

(*no extras*)

Personalization

Temporal Contiguity

Spatial Contiguity

Pretraining

Embodiment

Signaling

Redundancy

Segmenting

Key
- Applied
- *Mostly Applied*
- Inconclusive
- Not Applied

Fully　　Mostly　　Yes　　No　　Half　　Some　　None
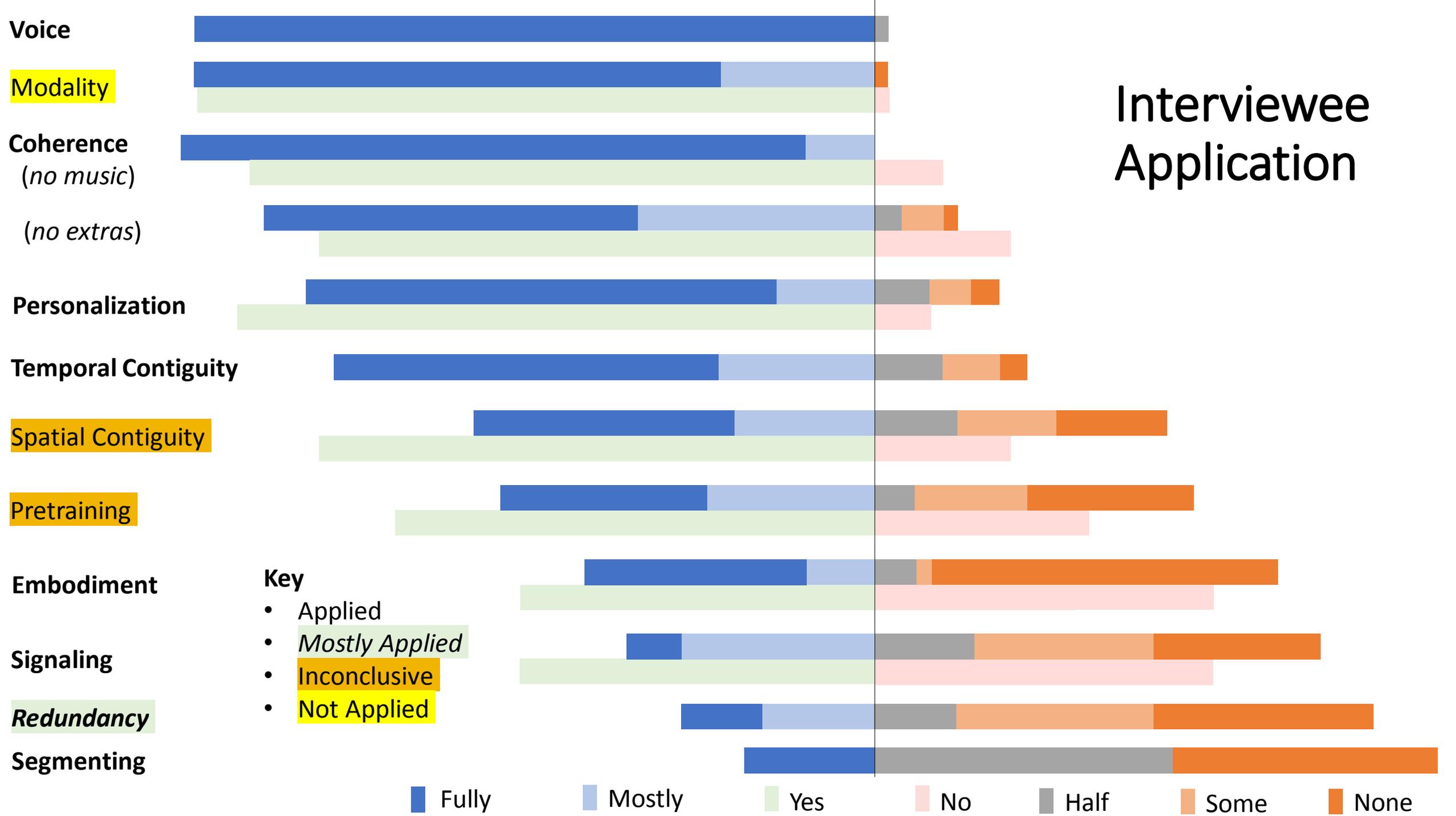
Modality
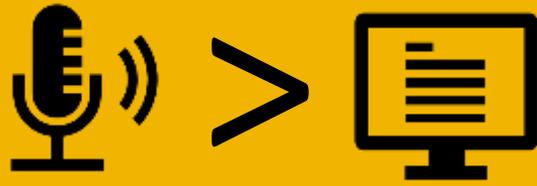
Instructor	Majority Text Slides (percent of video)	Redundant Reading (percent of majority text slides)
George	0.00	0.00
Kristine	47.36	7.92
Bertha	82.46	12.59
Tiana	100.00	6.74
Tessa	100.00	18.84

4. To what extent are CTML design principles an area of focus for instructors as they create video?

They are not a focus.

Directions for Future Research

1. Refine the survey instrument

2. Examine the CTML principles as a whole and not individually

3. Continue investigating principle "boundary conditions"

4. Instructor values around video production and tools

5. Replicate in other settings, especially not during a global pandemic

1	2	3	4	5
Be a Video Star	Add Some Signals	Check Your Text	Account for Time	It is Not the Tool, It is How You Use It

Thank You!

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Thomas Pantazes, Ed.D.

tpantazes@wcupa.edu

@TomPantazes

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References

Belt, E. & Lowenthal, P. (2020). Developing faculty to teach with technology: Themes from the literature. *TechTrends, 64*(2), 248-259. https://doi.org/10.1007/s11528-019-00447-6

Chorianopoulos, K. (2018). A Taxonomy of asynchronous instructional video styles. *International Review of Research in Open and Distributed Learning*, *19*(1). https://doi.org/10.19173/irrodl.v19i1.2920

Clark, R. C., & Mayer, R. E. (2016). *E-learning and the science of instruction: Proven guidelines for consumers and designers of multimedia learning*. John Wiley & Sons.

Creswell, J. W., & Clark, V. L. P. (2017). *Designing and conducting mixed methods research* (3rd ed.). Sage publications.

Guo, P.J., Kim, J., & Rubin, R. (2014). How video production affects student engagement: an empirical study of MOOC videos. In M. Sahami, A. Fox, M. Hearst, & M. T. H. Chi (Eds.), *Proceedings of the First ACM Conference on Learning @ Scale Conference – L@S 14,* (pp. 41-50). https://doi.org/10.1145/2556325.2566239

References

Kay, R. H. (2012). Exploring the use of video podcasts in education: A comprehensive review of the literature. *Computers in Human Behavior, 28*(3), 820–831. https://doi.org/10.1016/j.chb.2012.01.011

Mayer, R. E. (2019). Thirty years of research on online learning. *Applied Cognitive Psychology*, *33*(2), 152-159. https://doi.org/10.1002/acp.3482

Pan, G., Sen, S., Starrett, D. A., Bonk, C. J., Rodgers, M. L., Tikoo, M., & Powell, D. V. (2012). Instructor-made videos as a scaffolding tool. *Journal of Online Learning and Teaching*, *8*(4), 298-311. https://jolt.merlot.org/vol8no4/pan_1212.htm

Seaman, J. E., Allen, I. E., & Seaman, J. (2018). Grade increase: Tracking distance education in the United States. *Babson Survey Research Group*.