
WCU Virtual Research and Creative Activity Day
April 29, 2021
Thomas Pantazes, Ed.D.
Cognitive Theory of Multimedia Learning
CTML Design Principles

<table>
<thead>
<tr>
<th>Extraneous Cognitive Load</th>
<th><img src="image" alt="Extraneous" /></th>
</tr>
</thead>
<tbody>
<tr>
<td>Essential Cognitive Load</td>
<td><img src="image" alt="Essential" /></td>
</tr>
<tr>
<td>Germane Cognitive Load</td>
<td><img src="image" alt="Germane" /></td>
</tr>
</tbody>
</table>
CTML Design Principles

Extraneous Cognitive Load
- Coherence
- Signaling
- Redundancy
- Spatial Contiguity
- Temporal Contiguity

Essential Cognitive Load
- Pretraining
- Modality
- Segmenting

Germane Cognitive Load
- Personalization
- Embodiment
- Voice
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

1. Identified 138 instructors
2. Surveyed for 3 weeks
3. Calculated descriptive statistics
4. Calculated CTML implementation scores
5. Identified highest and lowest scoring design principles
6. Adjusted interview questions

Phase 2: Qualitative

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

Phase 3: Integration

1. Collected video artifact from each instructor
2. Hypothesis coded each video
3. Conducted pattern matching across three data sets
4. Wrote quantitative report
5. Wrote qualitative report

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Mixed Methods Explanatory Sequential Design
Setting and Sample

Public University

900 Instructors

140 Teaching Online
Instructor Profile

39.86% response rate
(55/138)

<table>
<thead>
<tr>
<th>College</th>
<th># Instructors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business</td>
<td>15</td>
</tr>
<tr>
<td>Humanities</td>
<td>7</td>
</tr>
<tr>
<td>Social Work &amp; Education</td>
<td>9</td>
</tr>
<tr>
<td>Health Sciences</td>
<td>14</td>
</tr>
<tr>
<td>Sciences</td>
<td>7</td>
</tr>
<tr>
<td>Other</td>
<td>3</td>
</tr>
</tbody>
</table>

94.6% Interest

<table>
<thead>
<tr>
<th>Interest</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly interested</td>
<td>36</td>
</tr>
<tr>
<td>Somewhat interested</td>
<td>16</td>
</tr>
<tr>
<td>Neutral</td>
<td>1</td>
</tr>
<tr>
<td>Somewhat uninterested</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>55</td>
</tr>
</tbody>
</table>
Digital Video Use

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

average number of videos per course was

23.13

14.04 videos made by the instructor

9.47 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?

<table>
<thead>
<tr>
<th></th>
<th>Simple CTML Scale (0 – 12)</th>
<th>Complex CTML Scale (11 - 55)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Score</td>
<td>7.0408</td>
<td>39</td>
</tr>
<tr>
<td>Median</td>
<td>7</td>
<td>39</td>
</tr>
<tr>
<td>Mode</td>
<td>8</td>
<td>36</td>
</tr>
<tr>
<td>Minimum</td>
<td>4</td>
<td>39</td>
</tr>
<tr>
<td>Maximum</td>
<td>10</td>
<td>47</td>
</tr>
<tr>
<td>Application</td>
<td>58.7%</td>
<td>70.9%</td>
</tr>
</tbody>
</table>

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

- 6 minutes or less: 19.1%
- 6 to 15 minutes: 42.6%
- More than 15 minutes: 38.3%

Median: 11:08
Average: 15:43
Approximately what percentage of the video contains text appearing on the screen that is read by the video narrator?

- 0%: 1
- 10%: 1
- 20%: 1
- 30%: 1
- 50%: 1
- 60%: 1
- 70%: 1
- 80%: 1
- 90%: 1
- 100%: 4

55% = Yikes!

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
3. Which CTML design principles appear in instructors self-selected “best” videos?

<p>| George | Kristine | Tessa | Bertha | Tiana |</p>
<table>
<thead>
<tr>
<th>Instructor</th>
<th>Majority Text Slides (percent of video)</th>
<th>Redundant Reading (percent of majority text slides)</th>
</tr>
</thead>
<tbody>
<tr>
<td>George</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Kristine</td>
<td>47.36</td>
<td>7.92</td>
</tr>
<tr>
<td>Bertha</td>
<td>82.46</td>
<td>12.59</td>
</tr>
<tr>
<td>Tiana</td>
<td>100.00</td>
<td>6.74</td>
</tr>
<tr>
<td>Tessa</td>
<td>100.00</td>
<td>18.84</td>
</tr>
</tbody>
</table>
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
Recommendations

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

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References


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](https://doi.org/10.1002/acp.3482)
