Slide Design

EVIDENCE-BASED

WARREN WIECHMANN, MD, MBA

2023
The delivery of quality healthcare should be driven by evidence-based principles.

As a clinician, it is my responsibility to practice medicine informed by the scientific evidence.
The delivery of quality **education** should be driven by **evidence-based principles**.

As an **educator**, it is my responsibility to **teach** informed by the **scientific evidence**.
Learning Objectives

1. **Review** the core principles that inform evidence-based multimedia instruction.

2. **Discuss** techniques to create effects in PowerPoint and Keynote that enhance your presentation.

3. **Discuss** additional applications of these techniques in other educational settings.

4. **Gather** resources that you can use to further improve your slides.

5. **Identify** opportunities within your teaching content to apply multimedia principles.
What will you learn today?

Slide design matters.

Good design promotes more effective learning.

Evidence-based slide design
by Warren Wiechmann, MD, MBA, MEd 2023
Evidence-based slide design by Warren Wiechmann, MBA, Med 2023
style + substance
Two foundational definitions

Multimedia Instruction = words + pictures

Printed text
Spoken text
Static images
Dynamic images

Evidence-based slide design by Warren Wiechmann, MD, MBA, MEd 2023
Two foundational definitions

**Multimedia Instruction** = **words** + **pictures**

- Printed text
- Spoken text
- Static images
- Dynamic images

**Multimedia Principle** = people learn better from **words** + **pictures** than words alone

Evidence-based slide design by Warren Wiechmann, MD, MBA, MEd 2023
The Cognitive Theory of Multimedia Learning

Based on 3 assumptions:
1. Dual-channels assumption
   Separate channels or pathways for processing visual (eyes) and auditory (ears) information

2. Limited capacity assumption
   There is a processing capacity in each channel at one time

3. Active processing assumption
   Active learning requires 4 steps:
   - Attend to incoming information,
   - Actively select relevant material,
   - Organize that material into mental representations,
   - Integrate selected material with existing knowledge
Dual-channels assumption

Separate channels or pathways for processing visual (eyes) and auditory (ears) information.
Breaking Down the Cognitive Theory of Multimedia Learning

Limited capacity assumption

There is a processing capacity in each channel at one time
Breaking Down the Cognitive Theory of Multimedia Learning

Active processing assumption:

1. Actively select relevant material
2. Organize that material into mental representations
3. Integrate selected material with existing knowledge

Attend to incoming information

Evidence-based slide design by Warren Wiechmann, MD, MBA, MEd 2023
Breaking Down the Cognitive Theory of Multimedia Learning

Learning requires processing. Processing has a fixed capacity. Learning is disrupted by additional processing burdens.
Breaking Down the Cognitive Theory of Multimedia Learning

Evidence-based slide design by Warren Wiechmann, MD, MBA, MEd 2023
Bad design

Evidence-based slide design by Warren Wiechmann, MD, MBA, MEd 2023
Breaking Down the Cognitive Theory of Multimedia Learning

Complex material

Extraneous Processing + Essential Processing + Generative Processing = 100%

MULTIMEDIA PRESENTATION

- Words
- Pictures

SENSORY MEMORY

- Ears: selecting words
- Eyes: selecting images

WORKING MEMORY

- Sounds: organizing words
- Images: organizing images

VERBAL MODEL

Pictorial Model

INTERGATING

LONG-TERM MEMORY

Prior Knowledge

Evidence-based slide design by Warren Wiechmann, MD, MBA, MEd 2023
Breaking Down the Cognitive Theory of Multimedia Learning

Where learning happens

MULTIMEDIA PRESENTATION

- Words (selecting words)
- Pictures (selecting images)

SENSORY MEMORY

- Ears (organizing words)
- Eyes (organizing images)

WORKING MEMORY

- Verbal Model
- Pictorial Model

LONG-TERM MEMORY

Prior Knowledge

= 100%

Evidence-based slide design by Warren Wiechmann, MD, MBA, MEd 2023
The Cognitive Theory of Multimedia Learning helps to explain the **Multimedia Principle**

Additional principles to address these three areas of processing

<table>
<thead>
<tr>
<th>Extraneous Processing</th>
<th>Essential Processing</th>
<th>Generative Processing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signaling (pointing)</td>
<td>Segmenting</td>
<td>Generative Activity</td>
</tr>
<tr>
<td>Spatial Contiguity</td>
<td>Pre-training</td>
<td>Personalization</td>
</tr>
<tr>
<td>Temporal Contiguity</td>
<td>Modality</td>
<td>Voice</td>
</tr>
<tr>
<td>Coherence</td>
<td>Coherence</td>
<td>Image</td>
</tr>
<tr>
<td>Redundancy</td>
<td>Redundancy</td>
<td>Embodiment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Immersion</td>
</tr>
</tbody>
</table>

Evidence-based slide design by Warren Wiechmann, MD, MBA, MEd 2023
Effect Size

Used to determine the **efficacy** of an intervention or educational practice relative to a comparison group or approach. Not only does the effect size indicate if an intervention would work, but it also predicts how much impact to expect in a range of scenarios.

<table>
<thead>
<tr>
<th>Effect Size</th>
<th>Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>d = +0.3</td>
<td>small</td>
</tr>
<tr>
<td>d = +0.4 - 0.6</td>
<td>moderate</td>
</tr>
<tr>
<td>d &gt; +0.7</td>
<td>high</td>
</tr>
</tbody>
</table>

Range from -2 to +2, most are -0.5 to +1.75

*p-value for education*

https://www.illuminateed.com/blog/2017/06/effect-size-educational-research-use/
The Multimedia Principle

People learn better from **words + pictures** than words alone

Median effect size of $d=1.35$

Evidence-based slide design by Warren Wiechmann, MD, MBA, MEd 2023
The Signaling Principle

Learning improves when cues highlight important information.

- Verbal (spoken or text)
- Visual (images)
- Live (pointing)

Work by reducing extraneous processing by directing attention towards important details.

Median effect size of $d=0.70$
The Signaling Principle

emphasis
color
font size
boxes
arrows
image overlays
icons
titles
The Spatial Contiguity Principle

a positive effect on learning when images and their corresponding words are closer in proximity to one another

Median effect size of $d=0.82$
The Temporal Contiguity Principle

a positive effect on learning when images and their corresponding words are presented together instead of consecutive order

Median effect size of $d=1.31$
The Coherence Principle

decrease extraneous processing by removing:
- interesting but irrelevant words
- unneeded words and symbols
- interesting but irrelevant music

Median effect size of $d=0.86$
The Redundancy Principle

learning is not improved when printed or on-screen text is added to a presentation that already contains images and spoken words

Median effect size of $d=0.72$

Wait...
Isn't that every live lecture?

Evidence-based slide design by Warren Wiechmann, MD, MBA, MEd 2023
The Redundancy Principle

There is a benefit of shorter text (signaling), but long blocks of text may be redundant.
The Segmenting Principle

ensure that working memory (essential processing) is not overloaded by breaking up complex messages into small parts

Median effect size of d=0.67
The Generative Activity Principle

people learn better when they prompted to carry out activities that **promote active learning**

Median effect size of $d=0.71$
The Generative Activity Principle

Prompts to engage in active learning include: summarizing, mapping, drawing, imaging, self-testing, self-explaining, or teaching.
The Generative Activity Principle

**Easy:**
Add a slide with a multiple choice question

**Easier:**
Add a slide that asks them to summarize the previous few slides
Evidence-based Slide Design Principles

Cognitive Theory of Multimedia Learning
Multimedia Principle
Signaling
Spatial Contiguity
Temporal Contiguity
Coherence
Redundancy
Segmenting
Generative Activity
Learning Objectives

1. **Review** the core principles that inform evidence-based multimedia instruction
2. **Discuss** techniques to create effects in PowerPoint and Keynote that enhance your presentation
3. **Discuss** additional applications of these techniques in other educational settings
4. **Gather** resources that you can use to further improve your slides
5. **Identify** opportunities within your teaching content to apply multimedia principles
Slide design principles are useful for digital or traditional research posters.
Learning Objectives

1. Review the core principles that inform evidence-based multimedia instruction

2. Discuss techniques to create effects in PowerPoint and Keynote that enhance your presentation

3. Discuss additional applications of these techniques in other educational settings

4. Gather resources that you can use to further improve your slides

5. Identify opportunities within your teaching content to apply multimedia principles
Learning Objectives

1. Review the core principles that inform evidence-based multimedia instruction
2. Discuss techniques to create effects in PowerPoint and Keynote that enhance your presentation
3. Discuss additional applications of these techniques in other educational settings
4. Gather resources that you can use to further improve your slides
5. Identify opportunities within your teaching content to apply multimedia principles