My Journey

Classroom connectivity in Algebra I classrooms: results of a randomized control trial

Stephen J. Pape\textsuperscript{a*}, Karen E. Irving\textsuperscript{b}, Douglas T. Owens\textsuperscript{b}, Christy K. Boscardin\textsuperscript{c}, Vehbi A. Sanalan\textsuperscript{d}, A. Louis Abrahamson\textsuperscript{e*}, Sukru Kaya\textsuperscript{f}, Hye Sook Shin\textsuperscript{g} and David Silver\textsuperscript{g}


Exploring benefits of audience-response systems on learning: a review of the literature

Christy Boscardin \textsuperscript{1}, William Penuel
Outline

1. Overview of Information Processing Theory
2. Implications for Instruction and Learning
Background on Information Processing Theory

- Theory developed by George Miller (in the 50s) to explain how humans process information.
- Uses computers as a metaphor for the way the humans process information.
- Useful since it specifies a sequence of three stages information goes through to become encoded into long-term memory:
  1. sensory, 2. short-term, and 3. long-term memory.
Information Processing Theory of 3 Stages
(Atkinson and Shiffrin Model)

1. Sensory (Register) Memory
   - Attention
   - Unattended information is lost

2. Working (Short-term) Memory
   - Encoding
   - Consolidation

3. Long-Term Memory
   - Retrieval
Only one of these images of a penny is correct. Which one is it? (POLL)

E. Hmm, can I check my wallet?
Selective Attention: Implications for Teaching

1. Sensory (Register) Memory
2. Working (Short-term) Memory

- Sensory memory works as a filter to selectively move information
- Gorilla experiment [Slide 8]
- Cocktail party phenomenon

**Priming the learners:**
- Sharing learning objectives/agenda
- Stimulus – Audio (playing music)
- Retrieval/Recall (Polls)
- Emotional trigger (Stories/music/Reflection)
Gorilla Experiment
Encoding from Short-term to Long-term

- Can hold 7 ± 2 information
- Encoding Processing Strategy:
  1. Rote rehearsal
  2. Imagery (Memory Palace)
  3. Chunking/Organizing
  4. Acronym (HOMES)
  5. Elaboration & Reflection
  6. Visual & Audio (Verbal) Reinforcement
  7. Retrieval Practice
## Encoding strategies: Chunking Example

### Memory Game

<table>
<thead>
<tr>
<th>Fruits</th>
<th>Protein</th>
<th>Baking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bananas</td>
<td>Chicken</td>
<td>Baking soda</td>
</tr>
<tr>
<td>Grapes</td>
<td>Pork</td>
<td>Flour</td>
</tr>
<tr>
<td>Apples</td>
<td>Beef</td>
<td>Egg</td>
</tr>
<tr>
<td>Oranges</td>
<td>Turkey</td>
<td>Sugar</td>
</tr>
</tbody>
</table>
Implications for Educational Technology

1. **Attention:**
   - Elicit questions to trigger existing schema (Polls)

2. **Encoding:**
   - Make the content meaningful (Breakout rooms & Elaboration)
   - Breaking-up information (Chunking, Change stimuli: Videos, Audio)

3. **Retrieval**
   - Retrieval practice (Polls)
   - Reflection & Taking Pause (for consolidation)
Part 2: Asynchronous Learning
Revisit Working Memory & Long-Term Memory

1. Sensory (Register) Memory
2. Working (Short-term) Memory
3. Long-Term Memory
Outline

Cognitive Load Theory

Dual Code Theory
Cognitive Load Theory

**Intrinsic load**: completing learning task

**Extraneous load**: unproductive attention to distractions, disruptions

**Germane load**: forming learning schemas, automating
Cognitive load & working memory

- Extraneous load
- Intrinsic load
- Germane load
Implications for Instruction

- **Match intrinsic load**
  - Chunking information
  - Right-size amount of content (20 min)
  - Optimize both visual and audio channels

- **Promote germane load**
  - Optimize visual and auditory channels
  - Chat
  - Zoom polls

- **Minimize extraneous load**
  - Slide design
  - Technology
  - Use familiar terminology
  - Minimize distractions
Paivio Dual Code (Processing) Theory: Cognitive Load
Three Implications for Instruction

- Optimize both verbal and non-verbal channel
- Decrease discordant information (decrease intrinsic)
- Decrease irrelevant information or distractions (decrease extraneous)