CAPTIVATING AUDIENCES BIG AND SMALL: TEACHING STRATEGIES AND TECHNOLOGICAL SOLUTIONS TO ENHANCE LEARNING

RACHEL STORK POEPPELMAN, MD
ANNA VOLERMAN, MD
IAN CHUA, MD
AMANDA EMKE, MD
SUSHANT SRINIVASAN, MD
ELISA RUANO, MD
TELL US ABOUT YOURSELVES!

- What are your teaching roles?
THE MANY HATS OF THE CLINICIAN EDUCATOR
TECHNOLOGY FOR CLINICIAN EDUCATORS
OBJECTIVES

- Apply relevant cognitive load theory principles to your teaching activities
- Employ instructional design strategies to optimize learner performance and knowledge retention for your teaching activities
- Use technological tools to promote learner engagement and demonstration of understanding with your teaching activities
COGNITIVE LOAD THEORY (CLT): MEMORY AND LEARNING

COGNITIVE LOAD THEORY (CLT)

- Intrinsic = task-specific
- Extraneous = distractions
- Germane = “learning”

Figure 3. The composition of cognitive load in early and advanced learners performing a similar task.

IF COGNITIVE LOAD THEORY WERE A WHEELBARROW…
APPLICATION TO YOUR TEACHING ROLE

- Think of one of your teaching roles
- Identify aspects of this teaching activity which comprise the different “loads”
  - Extraneous
  - Intrinsic
  - germane
CLT INSTRUCTIONAL DESIGN PRINCIPLES

- Decrease extraneous load
  - Display
  - Transmission
- Manage intrinsic load
- Optimize germane load
Rabies Replication

- Adsorption: Binds to unknown receptor in host via G-protein trimer
- Penetration: Internalized through receptor-mediated endocytosis
- Uncoating: Membrane of virion fuses with membrane of endosome
- Transcription: RNA-dependent RNA polymerase copies the antisense RNA into 5 protein-specific mRNA molecules
- Translation: P, M, N, and L mRNA are translated by free cytoplasmic ribosomes
- Processing: G mRNA translated by ribosomes bound to endoplasmic reticulum
- Replication: The P and L proteins make RNA polymerase which replicates the viral RNA into a (+) RNA. The (+) RNA is then copied into a (-) strand of RNA which associates with N protein to form nucleocapsid
- Assembly: Nucleocapsid and M protein assemble into virus at plasma membrane where G protein accumulated
DECREASE EXTRANEOUS LOAD: DISPLAY FACTORS

- Split Attention Effect
- Modality Effect (Dual Channel)
- Redundancy Effect
SPLIT ATTENTION EFFECT

- Relevant content should be related in space and time
  - Integration
  - Signaling

Fig. 9.3 Example of integrated explanatory text in coordinate geometry
Rabies Replication

- **Adsorption**: Binds to unknown receptor in host via G-protein trimer
- **Penetration**: Internalized through receptor-mediated endocytosis
- **Uncoating**: Membrane of virion fuses with membrane of endosome
- **Transcription**: RNA-dependent RNA polymerase copies the antisense RNA into 5 protein-specific mRNA molecules
- **Translation**: P, M, N, and L mRNA are translated by free cytoplasmic ribosomes
- **Processing**: G mRNA translated by ribosomes bound to endoplasmic reticulum
- **Replication**: The P and L proteins make RNA polymerase which replicates the viral RNA into a (+) RNA. The (+) RNA is then copied into a (-) strand of RNA which associates with N protein to form nucleocapsid
- **Assembly**: Nucleocapsid and M protein assemble into virus at plasma membrane where G protein accumulated
Dual Channel Processing

Replace written text with narration

Only applicable under certain conditions
- Reverse modality effect
- System vs. learner-paced
- Cueing/Signaling
Rabies Replication

- Adsorption: Binds to unknown receptor in host via G-protein trimer
- Penetration: Internalized through receptor-mediated endocytosis
- Uncoating: Membrane of virion fuses with membrane of endosome
- Transcription: RNA-dependent RNA polymerase copies the antisense RNA into 5 protein-specific mRNA molecules
- Translation: P, M, N, and L mRNA are translated by free cytoplasmic ribosomes
- Processing: G mRNA translated by ribosomes bound to endoplasmic reticulum
- Replication: The P and L proteins make RNA polymerase which replicates the viral RNA into a (+) RNA. The (+) RNA is then copied into a (-) strand of RNA which associates with N protein to form nucleocapsid
- Assembly: Nucleocapsid and M protein assemble into virus at plasma membrane where G protein accumulated

Cycle of Infection and Replication:

1. Adsorption
2. Penetration
3. Uncoating
4. Transcription
5. Translation
6. Processing
7. Replication
8. Assembly
9. Budding
10. Release

Modality
REDUNDANCY EFFECT

- Multiple sources of information that can be understood independently
  - Pacing
Rabies Replication

- **Adsorption**: Binds to unknown receptor in host via G-protein trimer
- **Penetration**: Internalized through receptor-mediated endocytosis
- **Uncoating**: Membrane of virion fuses with membrane of endosome
- **Transcription**: RNA-dependent RNA polymerase copies the anti-sense RNA into 5 protein-specific mRNA molecules
- **Translation**: P, M, N, and L mRNA are translated by free cytoplasmic ribosomes
- **Processing**: G mRNA translated by ribosomes bound to endoplasmic reticulum
- **Replication**: The P and L proteins make RNA polymerase which replicates the viral RNA into a (+) RNA. The (+) RNA is then copied into a (-) strand of RNA which associates with N protein to form nucleocapsid
- **Assembly**: Nucleocapsid and M protein assemble into virus at plasma membrane where G protein accumulated
Rabies Replication

Cycle of Infection and Replication

3. Uncoating
Virion and endosome membranes fuse

4. Transcription
Anti-sense RNA copied to mRNA

5. Translation
mRNA translated to proteins by ribosomes

6. Processing
ER glycosylates G-protein

7. Replication
Viral RNA is replicated to +RNA which is copied to −RNA for new virus

8. Assembly
G-protein, nucelocapsid and M protein assemble at the plasma membrane
DECREASE EXTRANEOUS LOAD: TRANSMISSION FACTORS

- Transiency
- Goal Free Effect
- Worked Example & Problem Completion Effect
Animated or verbal information is transient in nature
  - Can increase CL in novice learners
  - Pauses and pacing can help mitigate
GOAL FREE EFFECT

- Specific goal < non-specific goal
  - working backwards creates extraneous load
- Likely only applies to “transformation problems”
WORKED EXAMPLE & PROBLEM COMPLETION EFFECTS

- Worked example supplies problem solving schema
  - Must use alternation strategy
- Completion problem leaves out a piece for the learner to supply
- Learners attend to important parts of the problem without overloading working memory
APPLICATION ACTIVITY

- In groups of 3-4 discuss:
  - Why these slides have a lot of extraneous load
  - How can we use CLT principles to improve them
MANAGE INTRINSIC LOAD

- Isolated Elements
- Guidance Fading
ISOLATED ELEMENTS EFFECT: LEARNER KNOWLEDGE

- Goal is to help learners create partial schemas
- Present complex materials as isolated elements
  - Pre-training
  - Modular vs Molar approach
GUIDANCE FADING: TASK NATURE

- Progressively challenge learners more as they gain expertise
- “slower” fade for novice learners

Diagram:

Worked Example → Completion Task → Problem Solving
OPTIMIZE GERMANE LOAD

- Imagination & Self-explanation
- Variability Effect & Contextual Interference
- Elaborative interrogation
- Retrieval practice
Imagination techniques improve schema automation

“Mental rehearsal”

Self-explanation improves performance

Not effective for novices
Learning is promoted by:

- Problem variety
- “Random” practice
- Random practice may increase CL (“desirable difficulties”)
RETRIEVAL PRACTICE

- “Test-enhanced learning”
- Improves schema automation
APPLICATION ACTIVITY

- Apply these instructional strategies to your own teaching activities
TECHNOLOGY TOOLS
TECHNOLOGY TO SUPPORT WORKED EXAMPLE & PROBLEM COMPLETION

### Audience Response Systems
- Best for large group teaching
- Systems requiring a license can be financially prohibitive
- SMSpoll is free but limits the number of uses

### Cmap
- Software to create concept maps
- Allows for more complex problems

### Videos
- Good for large group or one-on-one clinical teaching
- Can utilize dual-modality

- [Poll Everywhere](#)
- [CmapTools](#)
- [Camtasia Studio](#)
TECHNOLOGY TO SUPPORT GERMANE LOAD STRATEGIES

- **Discussion Boards**
  - Best for large group teaching
  - Encourage self-explanation
  - Can be time consuming

- **Flashcard Decks**
  - Test-enhanced learning
  - Can be accessed on mobile devices

**TodaysMeet**

**Quizlet**

**StudyStack**
#FOAMped

Childrens ED @DHFTChildrensED - 11h

Wednesday's #postitpearls is about steroids in croup. Let the arguir
dosing begin! #foam #foamed #foamped #paediatrics #croup

---

STEROIDS in CROUP

Which?

Dexamethasone = Prednisolone

Local guideline choice

Date?

2016
THANKS FOR YOUR ATTENTION AND PARTICIPATION!

- How did we do?