Learning Science: I’m so smart smart

Van Hoof TJ, Doyle TJ Learning science as a potential new source of understanding and improvement for continuing education and continuing professional development Medical Teacher Jan 2018.

Background

There are a lot of ways to divide the HPE literature. See the tags for this show, for example. Typically on KeyLIME, we describe an UGME/GME/CPD division. An alternative is a teaching, learning and assessment division. And if you review past shows you see a heavy emphasis on assessment (my fav) and reasonable assessment on teaching (i.e. instructional methods), but “how we learn” is noticeably under represented. Let’s fix that.

Learning science is the emerging preferred term for the neuropsychology of brain processes associated with the development of new knowledge, skills and attitudes. Essentially, learning involves attention (to sensory memory with the overwhelming of inputs) coding (of information in the working memory into long term memory) and retrieval (accessing stored information from longterm memory.)

Apologies, but here is my rudimentary visual construction of the modal model of memory (full disclosure has been criticized for its simplistic/reductionistic representation of the complexity of the brain, but in my opinion provides a helpful framework to organize the numerous empiric studies that inform the theories of learning science.)

Apologies for the rudimentary nature of the diagram, but this is how I think of memory.
Purpose

“This article provides a brief description of learning, including the three key steps of encoding, consolidation and retrieval. The article also introduces four major learning-science strategies, known as distributed learning, retrieval practice, interleaving, and elaboration, which share the importance of considerable practice. Finally, the article describes how learning science aligns with the general findings from the most recent synthesis of systematic reviews about the effectiveness of continuing medical education.”

Key Points on the Methods

This is a narrative review. <insert rant here>. However, in this case, it’s an accessible overview of “background knowledge” (i.e. core/foundational knowledge that is well known and not overly disputed, in contrast to “foreground knowledge” which includes emerging evidence and theories that do not have wide consensus within the field).
Key Outcomes

Neurophysiology Pearls for CE:
Learning requires a physiological CHANGE in the brain. Learning is EFFORTFUL. Consolidation of new memory is influenced by SLEEP. The more DIVERSE and NUMEROUS the cues associated with a memory, the easier the retrieval and comprehension of the information.

Key Strategies to Optimize Learning:
1. Deliberate Practice
   Based on the work of Ericsson and others, high-quality, actionable, immediate, progressively-arranged feedback on performance that is frequently and regularly provided is critical to achieve expertise.

2. Distributed Learning
   Spacing out learning (via review sessions, retrieval practice, further elaboration) prevents the exponential "forgetting curve" originally described by Ebbinghaus. The 10% rule suggests that to recall information, the interval to return to the material should be approximately 10% of the time interval (e.g. to recall information at 1 year, review should occur every month). New information should be reviewed within 24 hours.

3. Retrieval Practice
   Recall of previously studied information is more effective than elaboration and significantly more effective than non-effortful re-reading of material. We have discussed this previously on KeyLIME here < Hyperlink to Episode 10>

4. Interleaving
   Massed practice (i.e. focusing on a single content area exclusively) is less effective than mixed practice where multiple content areas are included within a single study session. This is also more ecologically representative of everyday life, where multiple content areas are encountered.

5. Elaboration
   Comparing and integrating new information with existing information taken from multiple formats builds a richer and more accessible construct. Concept maps are one example of elaboration. Connecting readings and lectures to clinical cases is a classic example, where the arrangement and associations of connected information are not uniform, but complex.

Key Conclusions

The authors conclude...

"While learning within the human brain is not completely understood, some basic steps, such as encoding, consolidation and retrieval are known to be conceptually important and are increasingly linked to specific brain structures, such as the hippocampus, cingulate gyrus, and neocortex. Additionally, grounded in practice, learning science offers some practical strategies, including distributed learning, retrieval practice, interleaving and elaboration, which may help educators to adjust specific CE/CPD formats in support of achieving the most important outcomes, that is, clinician performance and patient outcomes."
Type of paper

Commentary

Tags

Clinical domain
General

Educational domain
Teaching and learning
Continuing professional development