

Context Matter to Promote Adult Learning in Medical Education

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Teaching and Learning

[To-may-to] / [To-mah-to]?

- **Teaching** refers to the act of communicating ideas, emotions, and/or skills to learners or students. It should be effective and optimal.
- **Learning** refers to the acquisition of new concepts or the modification of existing proficiency, knowledge or preferences and other aspects of behavior.

Traditional



Contemporary



What is Learning?

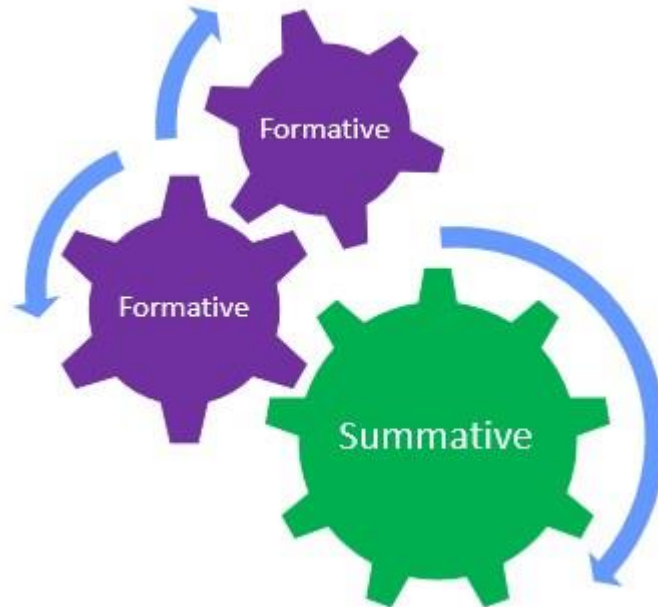
There is no argument in the notion that learning is a continued process that occurs throughout the different stages of life. According to the literature, learning:

1. Is active, engaging and *manipulating* (pedagogy context) objects, experiences, and conversations in order to build mental models of the world (Dewey, 1938; Piaget, 1964; Vygotsky, 1986). Learners build knowledge as they explore the world around them, observe and interact with phenomena, converse and engage with others, and make connections between new ideas and prior understandings.



What is Learning? - continued

2. Is summative, based on prior knowledge and involves enriching, building on, and changing existing understanding, where “one’s knowledge base is a scaffold that supports the construction of all future learning” (Alexander, 1996).



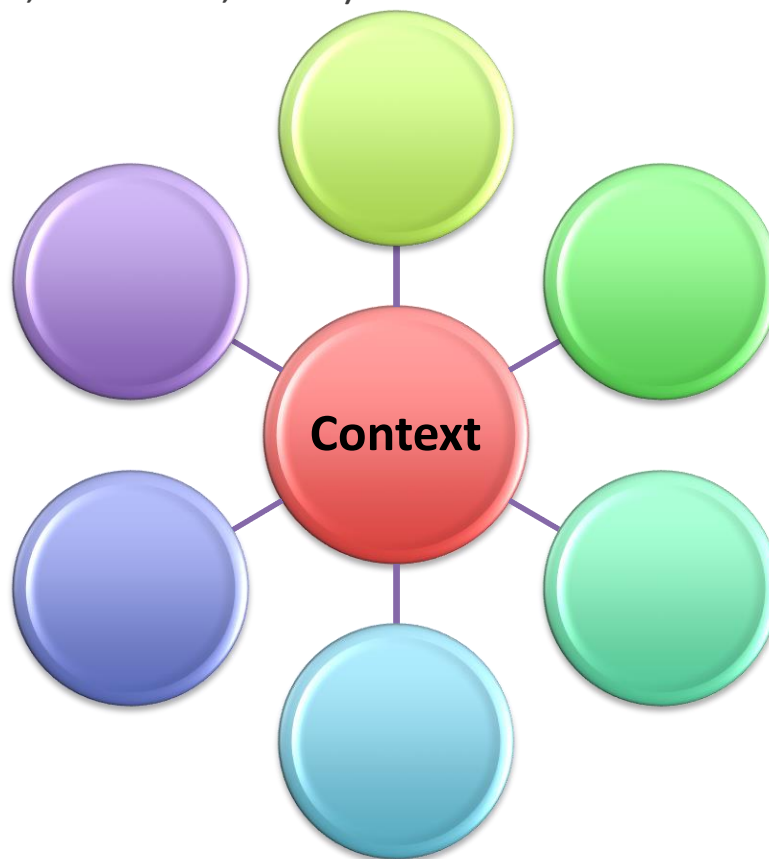
What is Learning? - continued

3. Is social, taking place in complex social settings; thereby should not limited to being examined or perceived as something that happens on an individual level. Instead, it is necessary to think of learning as a social activity involving people, tools, instruments, the words and language, the cultural context they're in, and the actions they take (Bransford, et al., 2006; Rogoff, 1998), and that knowledge is built by members (collaborative) in the learning activity (Scardamalia & Bereiter, 2006).



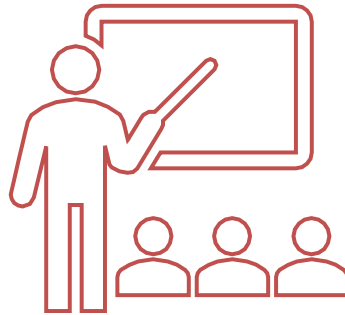
What is Learning? - continued

4. Is based on “context” (framework), which provides learners the opportunity to engage with specific ideas and concepts on a need-to-know or want-to-know basis (Greeno, 2006; Kolodner, 2006).



What is Learning? - continued

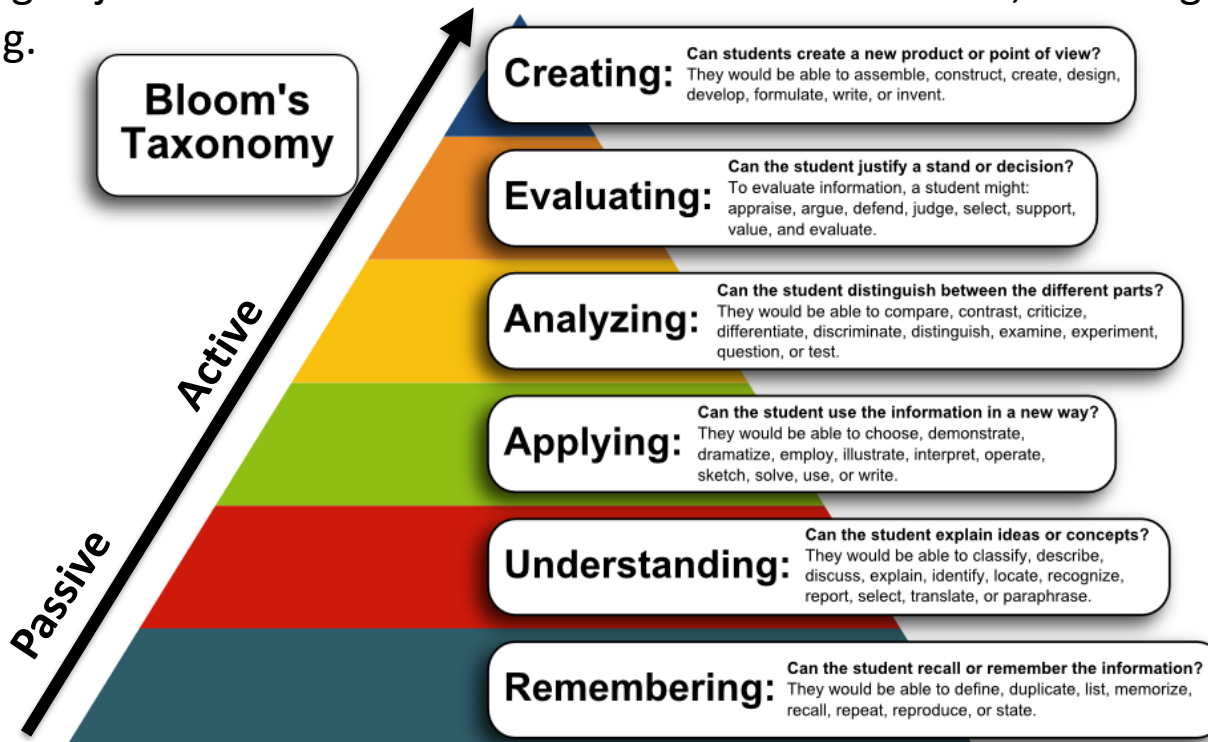
5. Is subjective, in the sense that involves the *learners' motivation and cognitive engagement* to be sustained when learning complex ideas, “because considerable mental effort and persistence are necessary to learn”.



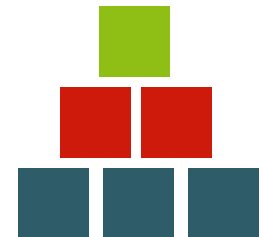
- Learning is much more than just the accumulation of facts and skills measured on tests or through competencies. **Learning, is best defined as the changes in practices that result from the interplay of all the elements of a system as the system itself morphs from the new practices.** (Larsen, 2019)

A Taxonomy for Teaching, Learning, and Assessment

- The Bloom's taxonomy is a powerful tool to help develop strong and intentional learning objectives (LO's) that support the process of learning.
 - Lower tier elements should not be interpreted as inferior, but foundational.
- Assists in the creation of appropriate instructional strategies that will enable students to complete the learning activities successfully.
- Learning objectives are considered the framework for both, teaching and learning.

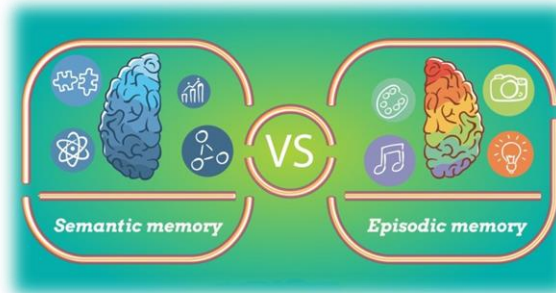


From: courses.dcs.wisc.edu



Learning requires Memory and Recall

- Memorizing/recalling capabilities are highly variable, varying among different people, ages, gender, etc.



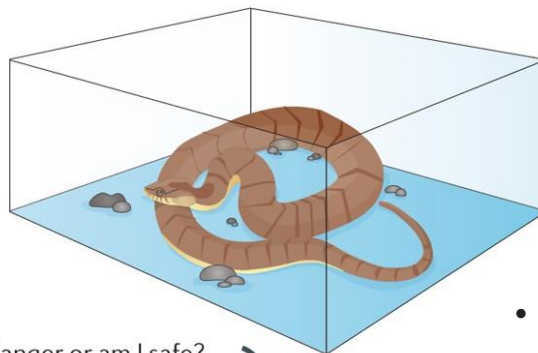
- For learning to take place, it requires that the information that is processed (*encoding*) is then committed to memory (*storage*) and that the student can pull it back out (*retrieval*) when it's needed (let alone apply it to a novel circumstance through adaptation and abstraction).
 1. **Encoding**- forming new memories
 2. **Storing**- maintaining the information created from memories
 - *Context, integration, more integration*
 3. **Retrieving**- gaining access to the stored information
 - *Our ability to access a given memory typically declines over time, primarily due to interference caused by the acquisition of new, competing memories.*
- Retrieval makes the memory itself more recallable in the future!
 - **Retrieval is *cue and context-dependent***

Circuits involved in “cue and context” processing in the human brain

Snake (encounter in woods)



Snake (exhibit at zoo)

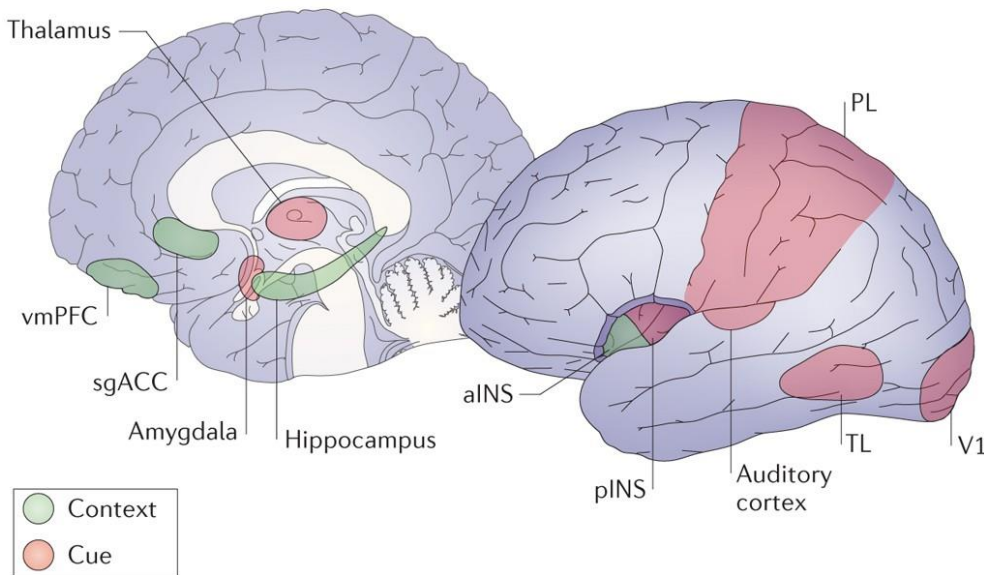


Am I in danger or am I safe?

- Is it a snake (or a twig)?
- Is it moving (towards me)?
- Where is it? Where am I?

- Context provides pivotal information for the understanding of the meaning of events.

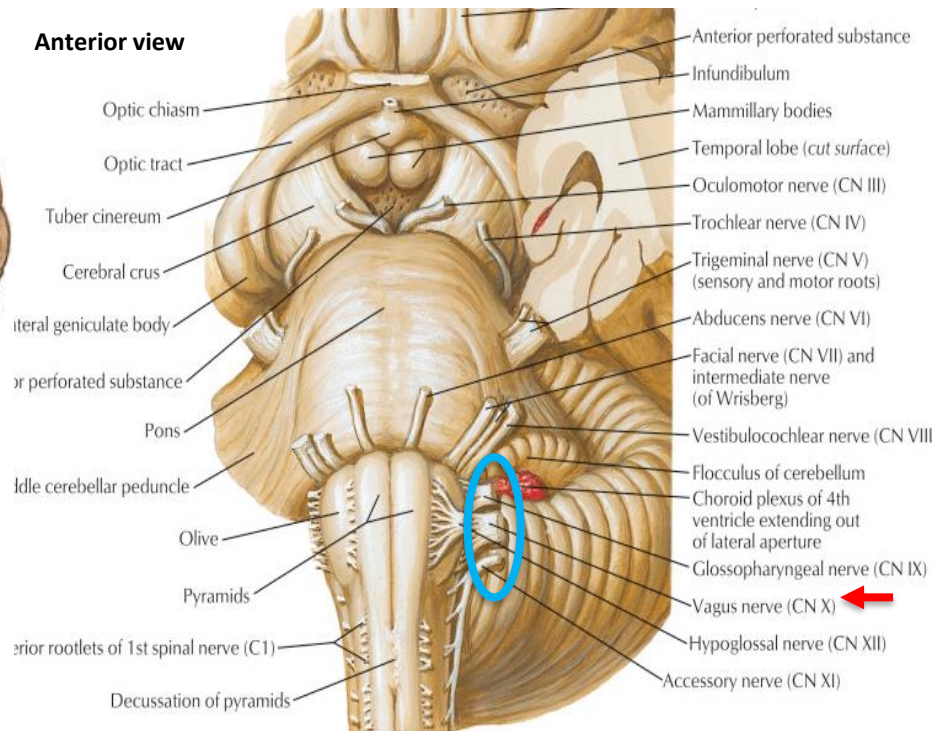
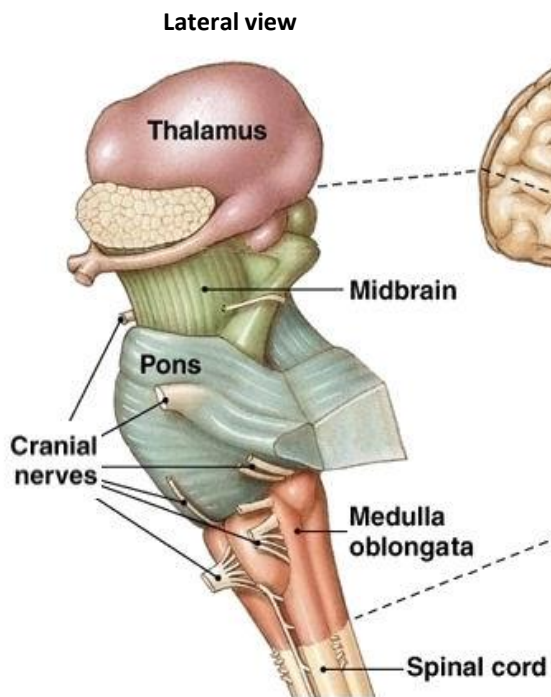
- The **hippocampus** and **medial prefrontal cortex** are critical for encoding and retrieving contextual information. This circuit functions in the disambiguation of cues that have different meanings in different contexts.



Contextualizing the Retrieval Process via Cues

- **Cues**, making as many connections (*i.e., conceptual*) as possible with existing memories. (adding cranial nerves content to the existing brain knowledge)

Example: The brainstem is part of the brain. The brainstem has varied cranial nerves (CNs). CN X exits the brain along with CNs IX & XI. It carries many vital autonomic functions and responses.



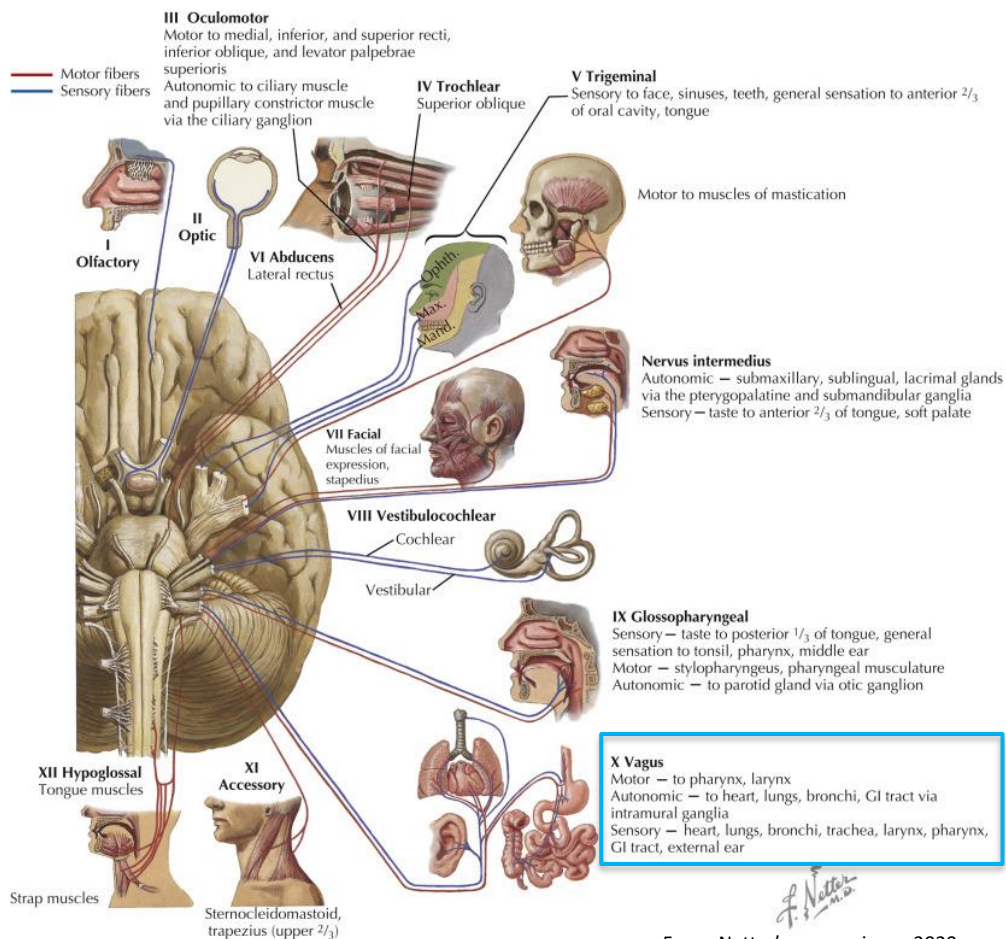
From: stevemallory.org/brainstem/

From: Netter's neuroscience 2020

Retrieval Process- continued

- **Context**, the more closely matched the retrieval context is with the context in which the memory was encoded, the better.

Example: The vagus nerve (CN X) is involved in varied autonomic functions such as respiration, cardiac, swallowing, digestion, absorption and metabolism, etc. Although, it leaves the brain along with CNs IX & XI, its functions are different from CNs IX & XI.

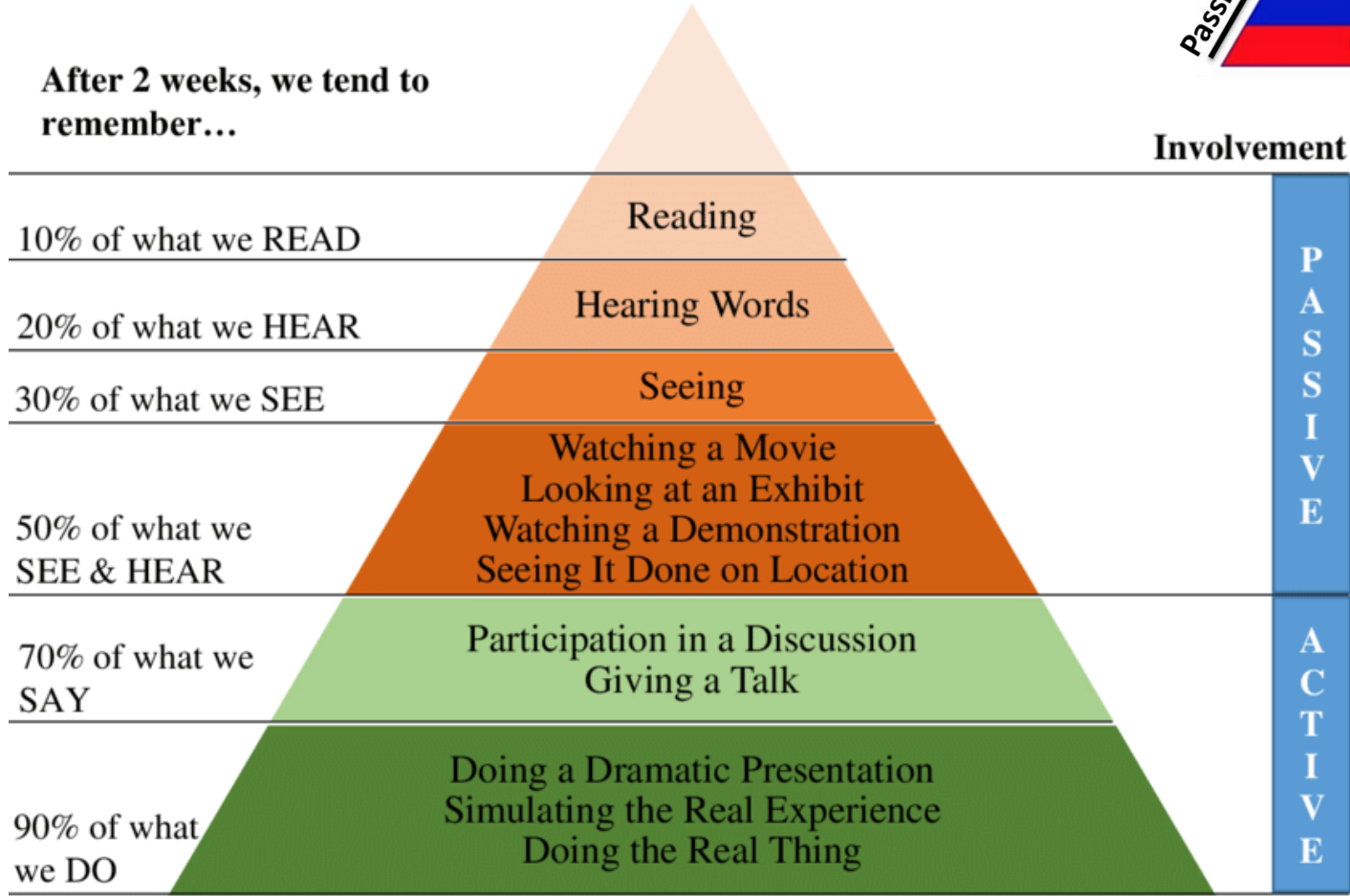
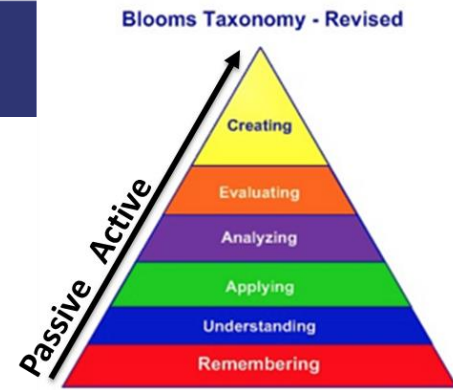


Passive vs Active Learning

Learning Modality <ul style="list-style-type: none"> Delivery modes/strategies 	Perceptions and Experiences	Outcomes
<p>Passive</p> <ul style="list-style-type: none"> Lectures, seminars, presentations Direct instructions, Modeled instruction Watching videos, TV Listening to podcasts Reading books, magazines, journals, handouts 	<ul style="list-style-type: none"> Lecture-based <ul style="list-style-type: none"> Teacher talks- student listens (hopefully) Teacher-centered <ul style="list-style-type: none"> Q/A: Student/Teacher Limited resources <ul style="list-style-type: none"> Textbook, lectures, handouts Students work individually or controlled groups Static Assessment <ul style="list-style-type: none"> Specific topics are tested 	<ul style="list-style-type: none"> Apathy, disregard Disengagement Unmotivating behaviors (i.e., bore) Limited (superficial) understanding Shoves and crams materials for testing
<p>Active</p> <ul style="list-style-type: none"> Case-based instruction <ul style="list-style-type: none"> Small group activities Problem-based instruction <ul style="list-style-type: none"> Small group activities Team-based learning Collaborative learning Flipped classroom, role playing, debates Clinical PEARLS Paired or small group discussions, reciprocal (Socratic) questioning Gamification 	<ul style="list-style-type: none"> Facilitation-based <ul style="list-style-type: none"> Peer-peer discussion Learner-centered <ul style="list-style-type: none"> Deep and effective topic discussions Critical thinking, creativity Collaborative <ul style="list-style-type: none"> Learners share perspective, ideas and multidimensional solutions to problems or tasks 	<ul style="list-style-type: none"> <i>Excitement</i> <i>Active engagement</i> <i>Empowering, motivating</i> <i>Integrated, deep conceptual and contextual understanding of topics</i>

Passive vs Active Learning- continued

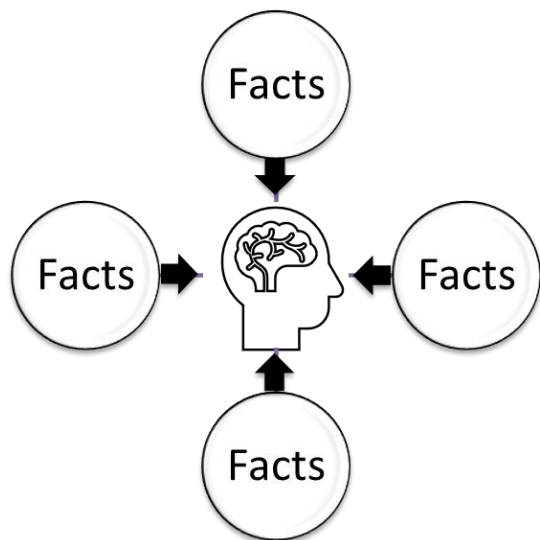
Dale's Cone of Experience (Learning by doing model)



Active Learning (AL)

- Learning occurs best through *critical thinking, problem-solving, effective discussions, collaborative activities* and *integrating concepts*.
- Fosters **divergent thinking** over convergent thinking.
 - By focusing on the *big picture*, learners develop multiple creative ideas/solutions to a topic.

Convergent Thinking



Enumerate the 12 pairs of cranial nerves.
 Describe their location and main functions.

Divergent Thinking

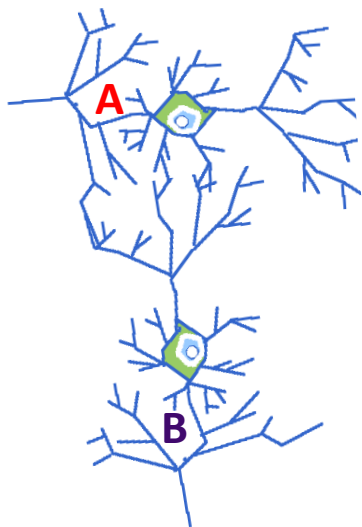


Elaborate a concept map integrating the 12 pairs of cranial nerves. Emphasize their structure, location and functional significance.

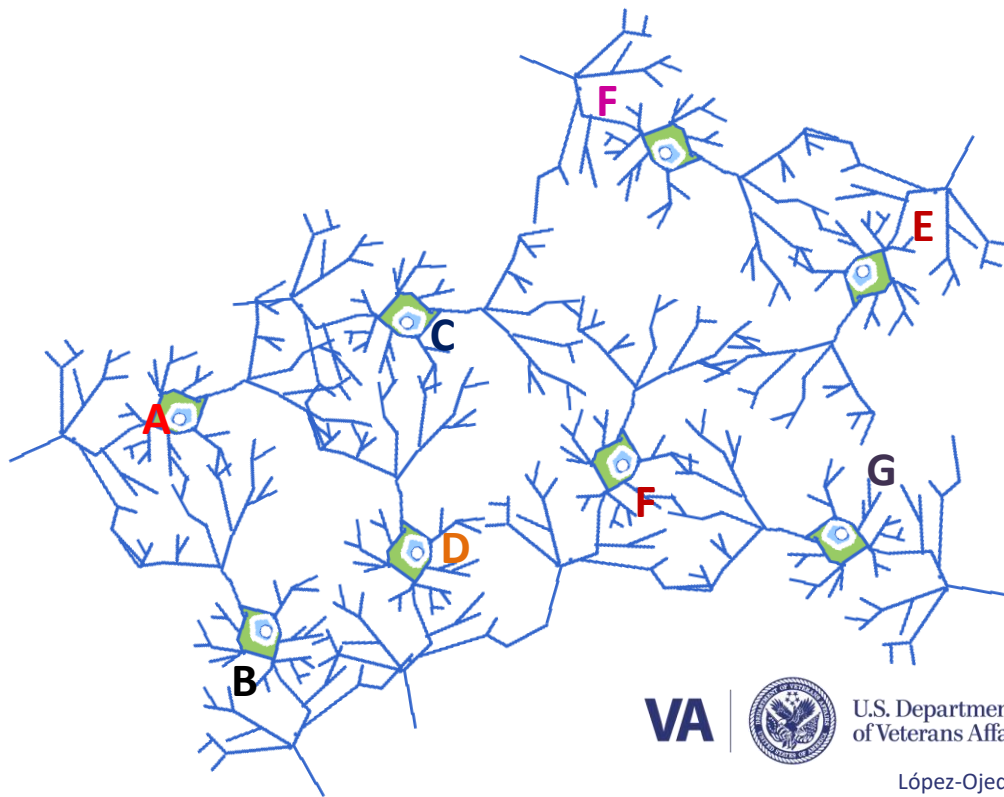
Active Learning- continued

- Passive learning may lead to fewer neurons connections; however active learning practices elicit multisensorial stimuli leading to deeply embedded neural circuits.
- Diverging neural circuits not only consolidate (cortex) memories better, but also make them highly *retrievable*.

Passive Learning
(Converging pathway)



Active Learning
(Diverging pathway)

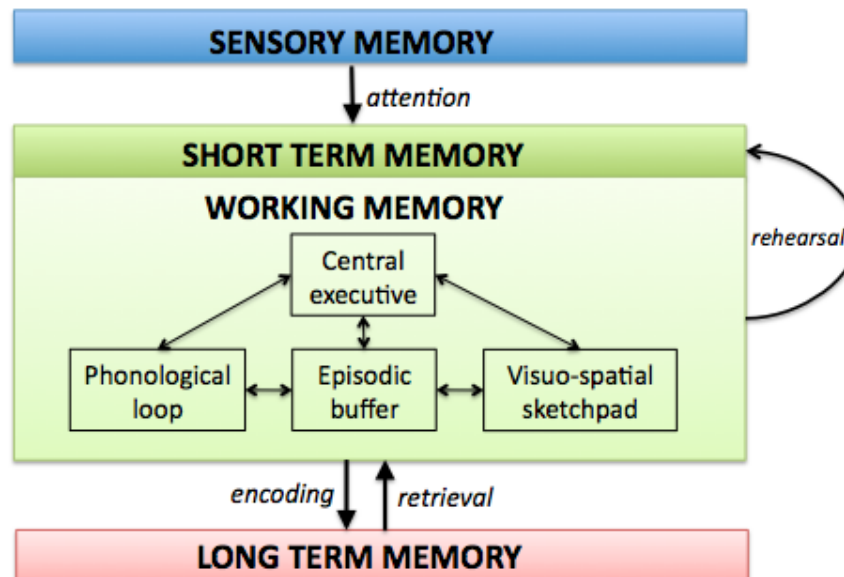


Active Learning - continued

- When designing active learning activities be mindful about the “*Cognitive load*”

Cognitive load (CL):

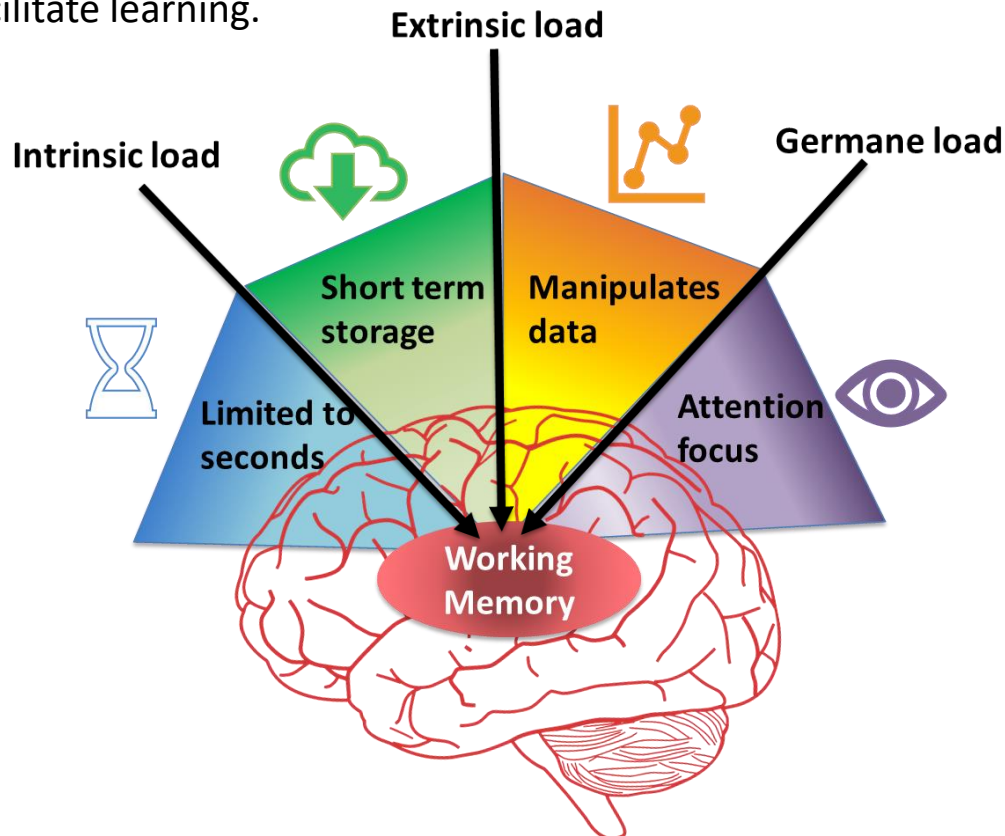
- First coined by psychologist John Sweller in the late 1980s, is a popular cognitive learning theory gaining traction in medical education for its guiding principles on how to scaffold learning specially for neophytes (beginners).
- Working memory (WM) has a limited capacity to process new information. However, long-term memory, in theory, can store an unlimited amount of learned information using logical neural networks.



From: intro-psychology portfolio

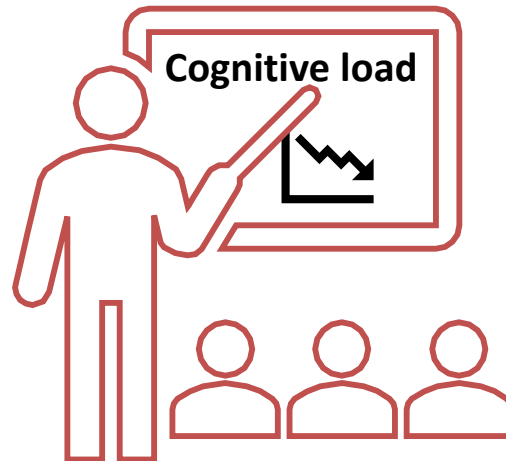
Active Learning - continued

- CL in the working memory is influenced by three different elements (summative loads):
 - Intrinsic* load- nature of the **contents** to be learned, associated with performing essential aspects of the task. Complexity of the information.
 - Extrinsic (Extraneous)* load- how contents are presented (teacher), typically non-essential aspects of the task.
 - Germane* load- refers to the strategies/schemas (desirable) used by the learner to learn any given content and the deliberate use of cognitive strategies that facilitate learning.



Active Learning - continued

- Teaching strategies can either increase or **decrease** the CL imposed on learners' working memories, depending on the design.
 - Well designed and organized activities can enhance learning during the initial processing (encoding) step taking place in the working memory.
 - Poorly designed activities increase the CL, thus reducing learning potential in overall.



Active Learning - continued

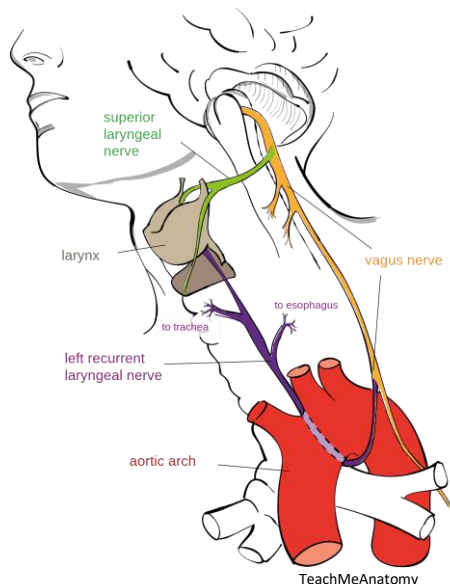
Cognitive load

DECREASED

- Illustrate a diagram of the vagus nerve pathways indicating the main branches supplying the *laryngeal apparatus*. Briefly, describe its functions *focusing* on the laryngeal structures.

VAGUS NERVE

- Carries signals containing

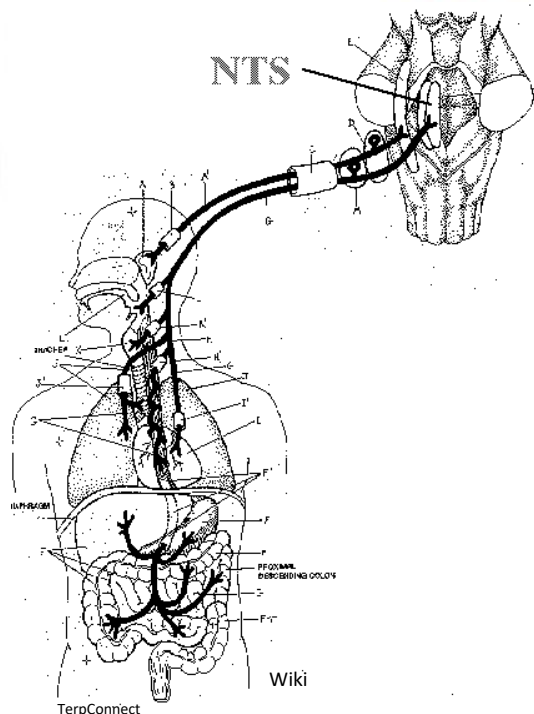


INCREASED

- Illustrate a diagram of the vagus nerve pathways indicating **all the human organs and systems regulated by its autonomic functions**. Briefly, describe **all major functions**.

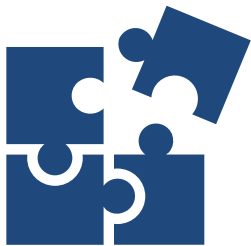
VAGUS NERVE

- Carries signals containing



Active Learning Pedagogies

- **Providing intentional and effective “context”**
- Problem-based Learning (PBL)- learners analyze clinical data in medical scenario to solve a clinical problem providing suitable solutions
 - Cases with mini clinical pearls
 - Clinical Vignettes, real clinical scenarios
 - Learners work in small groups completing different tasks
 - *Instructor/facilitator involvement is indirect, acting merely as a moderator*



From: Emaze

Active Learning Pedagogies- continued

- Case-Based Learning (CBL)- learners are given a case that unfolds over a predetermined time period (i.e., 1-4 week(s)).
 - Clinical pearls
 - Patients medical history, laboratory results and other clinical tests
 - Learners engage in different small group activities
 - *Instructor/facilitator is heavily involved leading the activities*



From: blogs.warwick.ac.uk/mbchbstudents/entry/case_based_learning/

Active Learning Pedagogies - continued

- Team-based learning (TBL)- learners assume roles of greater autonomy and responsibility for their learning. Some critical components of TBL are
 - 1) Groups that are permanent, so they have time to develop a “team” (trust).
 - 2) Prework, a process to ensure individual student readiness for group work.
 - 3) Homework, which allows team members to work collectively on rigorous application of course content(s) beyond the face-to-face activities.
- Clinical pearls
- Patients medical history, laboratory results and other clinical tests
- Learners engage in small group activities within a larger group setting
- *Instructor/facilitator is heavily involved leading the activities*







From:news.tulane.edu/

Other Active Learning Strategies

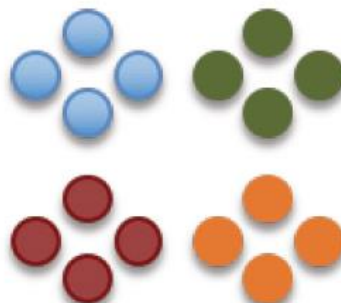
- Group Teaching or Jigsaw (group activity)

Select 2-3 concepts, or questions around a single topic (i.e., Cardiac tamponade). Divide learners into small groups of 3-4 to work on their assigned concept/question. After groups have some time (15-20 min) to work on it, they spend time (10-15 min) teaching/explaining/discussing their rationale to the members of other group(s).

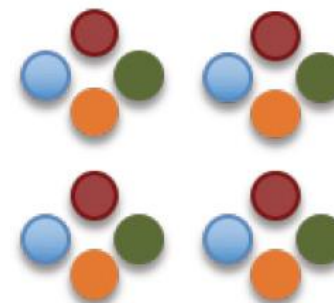
Example:

-  Which anatomical structures are commonly involved in a cardiac tamponade?
-  Explain what is a cardiac tamponade and its most common causes.
-  How is diagnosed? Which clinical tests are most appropriate? Why?
-  Explain the pathophysiology of a cardiac tamponade and its most common causes.

Expert Groups



Sharing Groups



Other Active Learning Strategies- continued

- Work at the Whiteboard (group activity)

Learners are divided in small groups of (3-4) and instructed to go to the whiteboard to solve a clinical problem (i.e., Best practices for skeletal fractures Dx/Tx). If there is insufficient whiteboard space, students can still work out problems as a group while sitting , using chart paper, markers, tablets, etc.

Example: Make a concept map detailing the best clinical practices (Dx/Tx) for the manage and care of skeletal fractures in the ER.



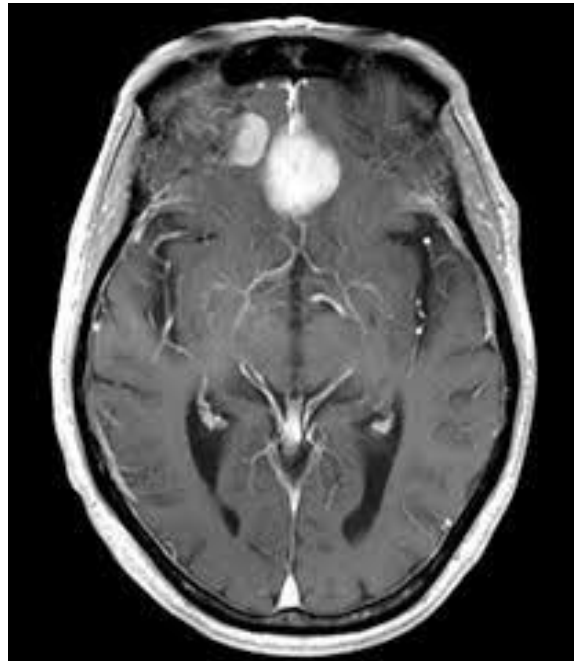
shutterstock.com

Other Active Learning Strategies- continued

- Think-Pair-Share (partner and group activity)

Learners work on a specific question or task that requires higher order thinking (e.g., application, analysis, or evaluation levels). Students will think/provide an answer for one minute, then turn to a peer to discuss their responses for two minutes. Responses are shared among groups and followed by instructor's explanation and clarification.

Example: Which brain pathology can be seen in the following MRI?
What is its anatomical location?



From: Clinical MRI

Take Away Points

- Active learning fosters critical thinking. Learners take responsibility for their learning by engaging on intentional activities or discussions. Facilitators reduce control, increase facilitation and promote independent learning.
- AL emphasizes higher-order thinking and often involves group or teamwork.
- Well-designed AL teaching activities have been found to be effective for maximizing learning, engagement, peer collaboration and evidence-based medicine practices.
- Be mindful about the elements affecting the cognitive load. Plan and organize your active learning strategies focusing on *reducing* the cognitive load. When the CL associated with a task exceeds the learner's working memory capacity, performance and learning is impaired.
- Not every instructor is comfortable or an expert in the approaches to AL instruction. And, not all students appreciate its advantages over passive practices, specially because for most students and many teachers passive learning represents comfort zone.
- Although technological advances and innovative resources are proven effective for AL, they are not essential components or elements to assure its success.

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Questions, more information?

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