Lecturio Start Smart

Clear the Clutter

Cognitive load theory tips for health professions educators

lecturio

Today's Speaker

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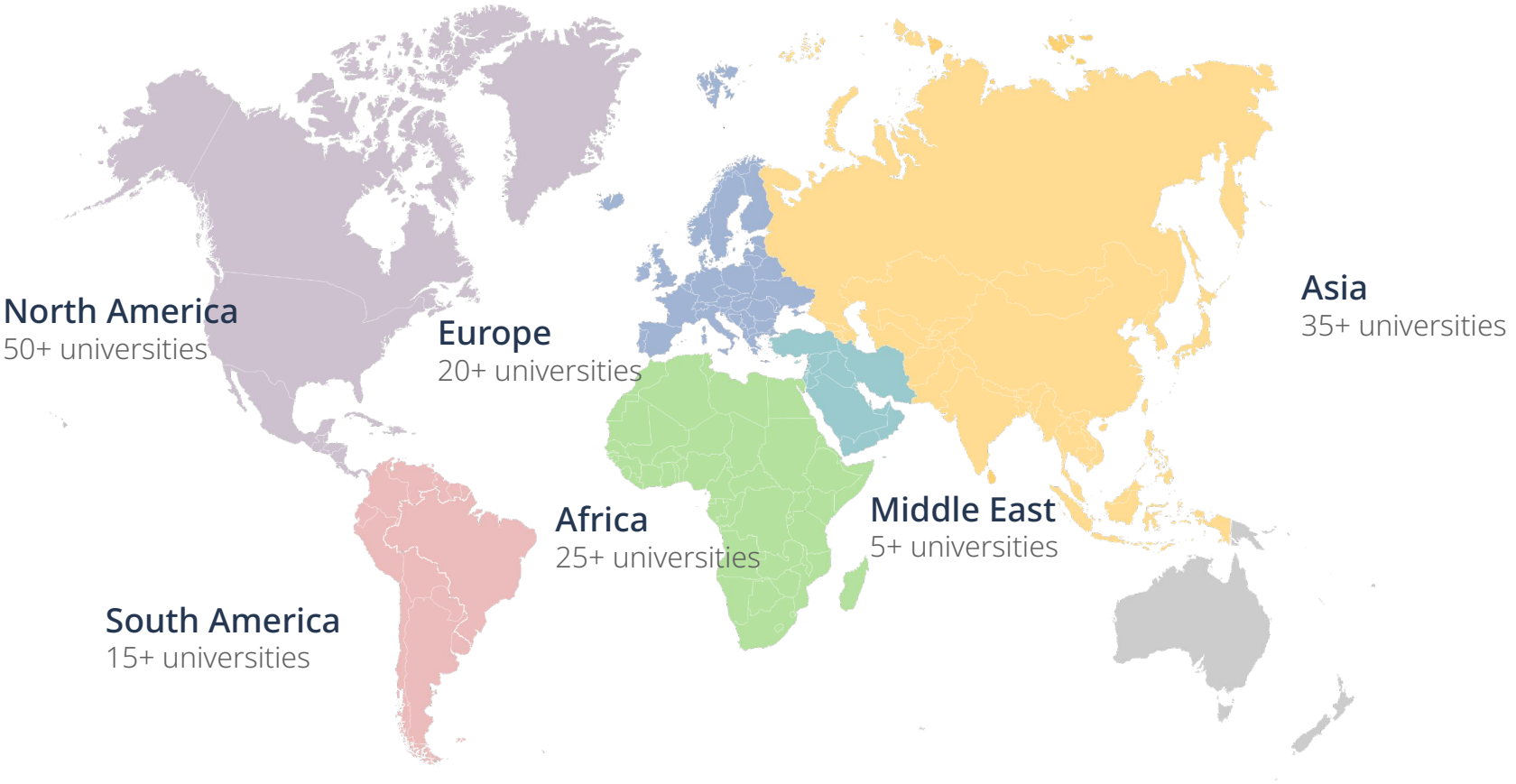
Resident Doctor, Surrey and Sussex Healthcare NHS Trust, UK

Member of the Academy of Medical Educators

Medical Education Consultant, Lecturio

Agenda

1. Introduction to Lecturio
2. Memory and cognitive load
3. Cognitive load theory
4. Managing cognitive load
5. Q&A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50+ universities
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Asia
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Middle East
5+ universities
South America
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Get Your Resource Pack Now!

Download our complimentary Start Smart resources pack, specifically designed to help educators like you to kick off the with innovative teaching strategies.

Medical

Nursing

Who Are We?

Lecturio

comprehensive digital medical education platform

Content from professors including from

Yale University School of Medicine

HARVARD UNIVERSITY

Stanford University

BROWN Alpert Medical School

JOHNS HOPKINS SCHOOL of MEDICINE

Lecturio Covers the Entire

Medical & Nursing

Curricula in all key learning formats

12,000+ High-End Videos
in TV quality, short, and engaging

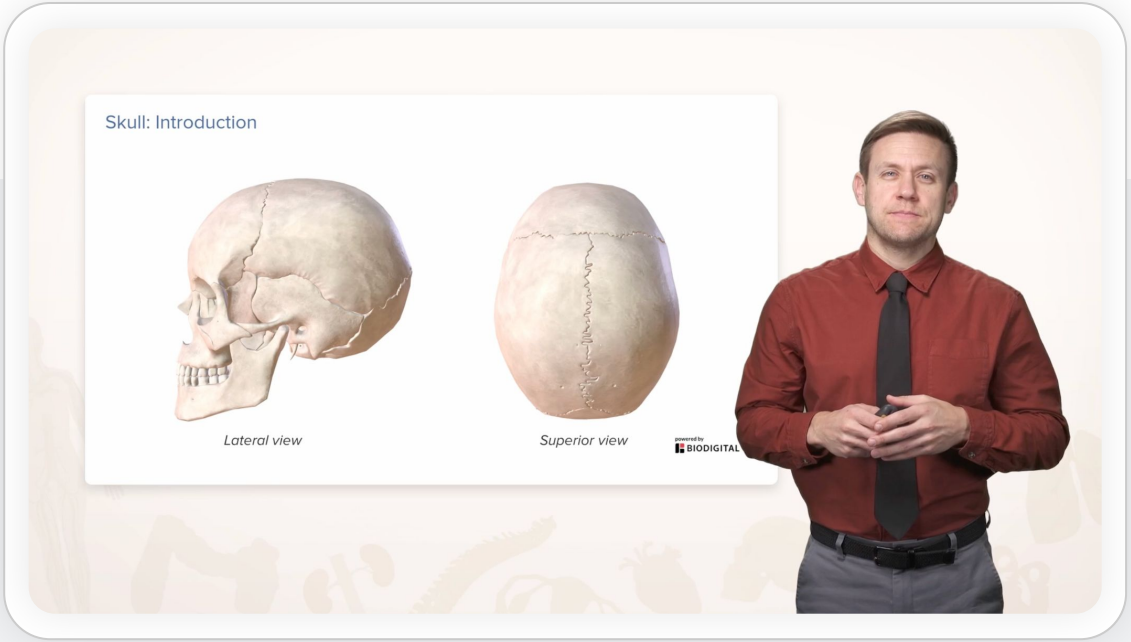
9,800+ Clinical Cases
with text and video explanations

35,000+ Recall Questions
using a spaced repetition algorithm and adaptive review

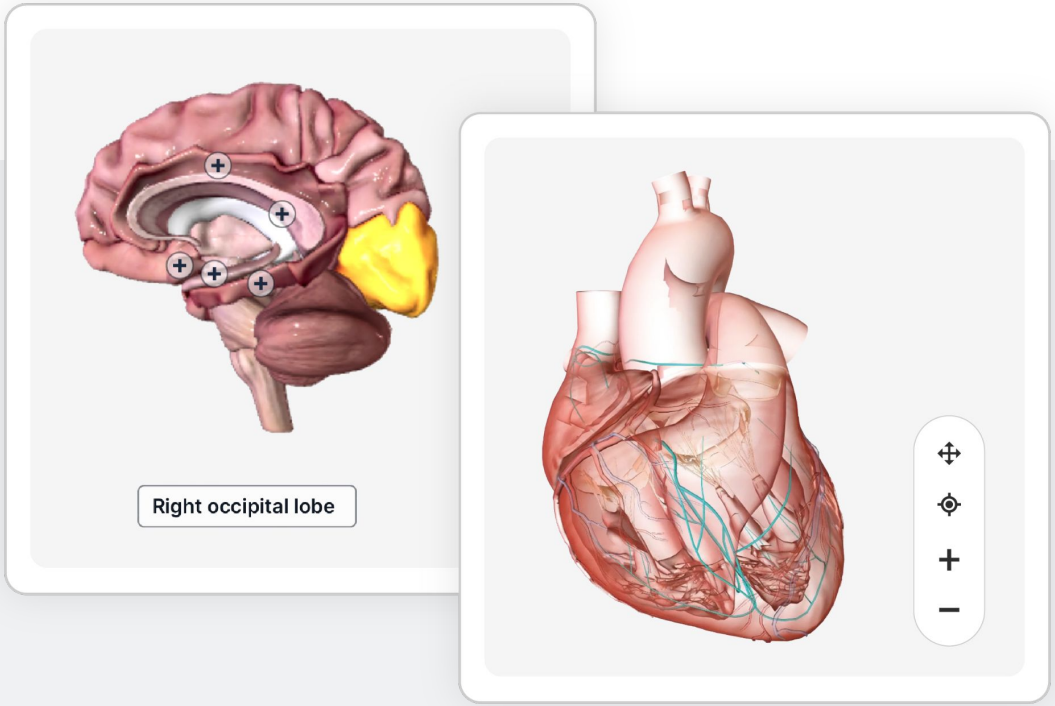
1,500+ Concept Pages
organized in a comprehensive library

Concise Videos on All Key Concepts

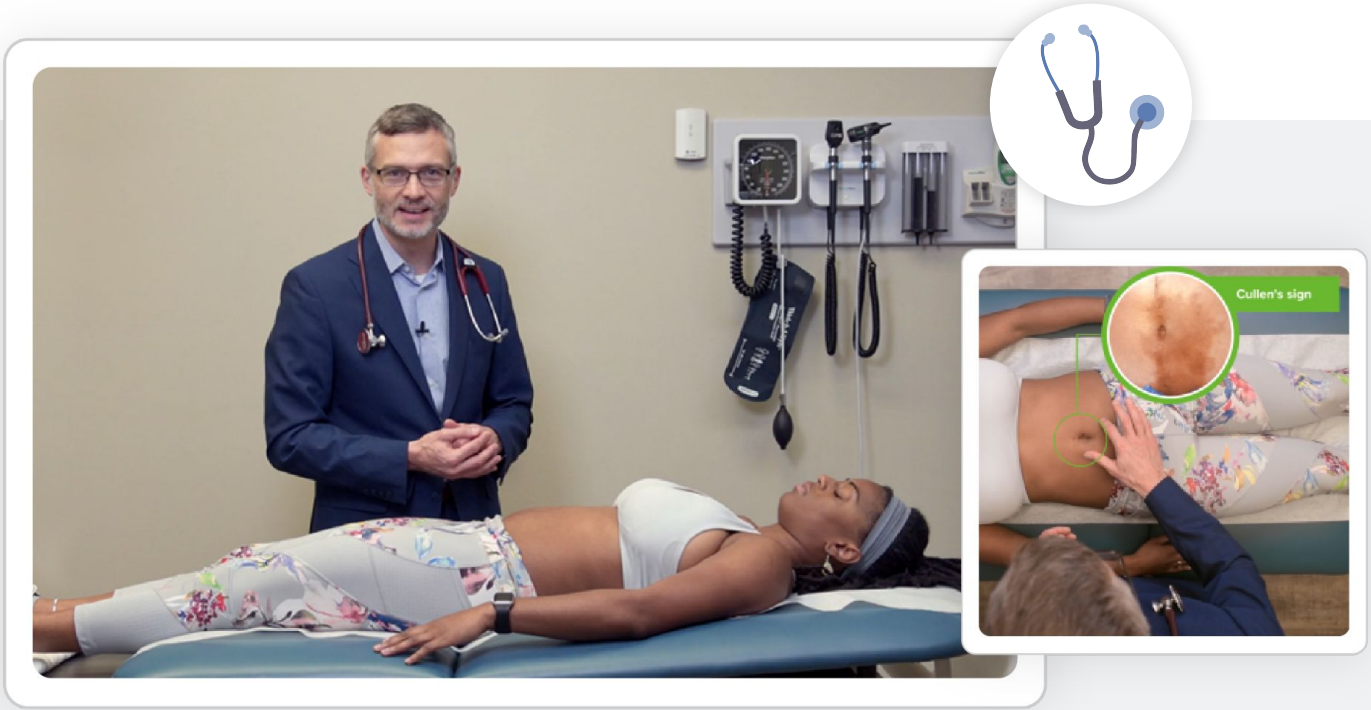
- All key medical concepts are covered in-depth
- 3-9 minutes
- Linked recall questions for formative assessment



3D Anatomy With 400 Pre-Mapped Views



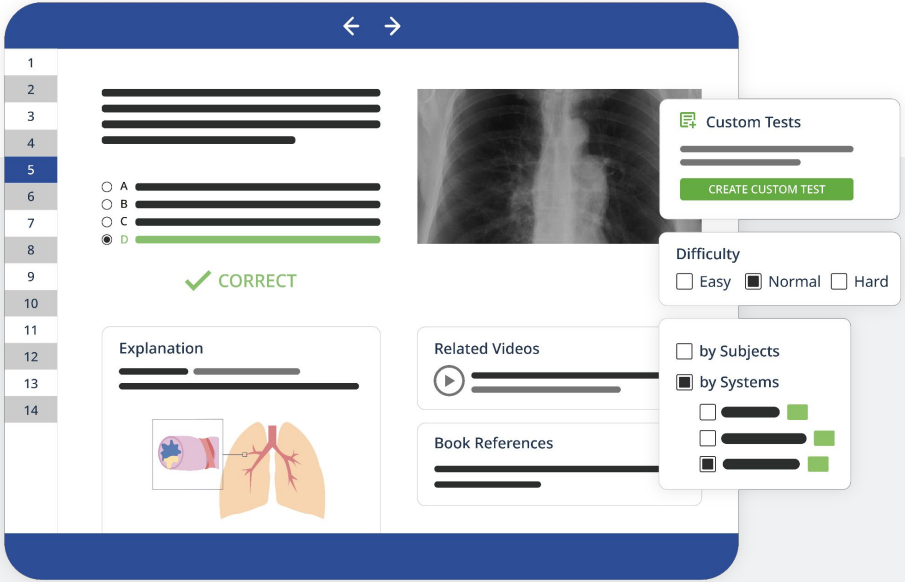
Comprehensive Coverage of Clinical Skills



Comprehensive Coverage of Clinical Skills

Clinical Cases to Practice Application of Learned Concepts

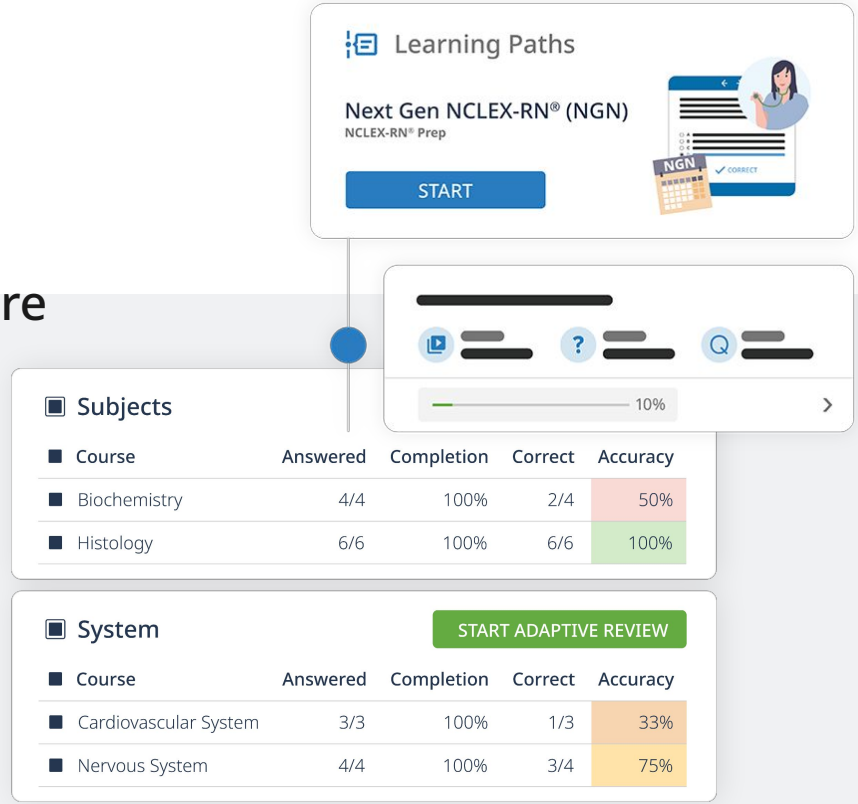
- Real-life clinical scenarios
- Automated feedback
- Linked videos
- Use for self-directed learning or exams



Detailed Learning Paths

for USMLE® Step 1, 2, NBME Subject Exams, NP, NGN & More

- Learning Paths combine video and Qbank blocks
- **Adaptive review** within each path



Lecturio Concept Pages

The fastest and easiest way to find and fill knowledge gaps

Heart: Anatomy

The heart is a 4-chambered muscular pump made primarily of cardiac muscle tissue. The heart is divided into 4 chambers: 2 upper cham
receiving blood from the great vessels, known as the right and left atria, and 2 stronger lower chambers, known as the right and left ventricle
pump blood throughout the body. Blood flows through the heart in 1 direction, moving from the right side of the heart, through the lungs, a
returning to the left side of the heart, where it is pumped out to the rest of the body. As blood moves through the heart, 4 important valves
backflow. The heart muscle itself is supplied by the coronary arteries. The heart also has its own conduction system, triggering its own
contractions.

Last updated: March 10, 2023

0/10 questions correct

START TEST

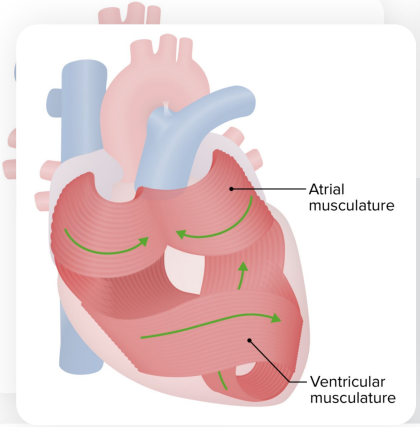
CONTENTS

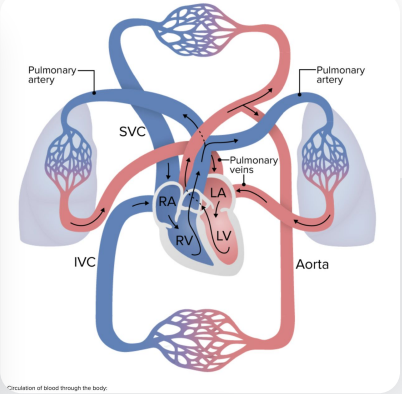
General Structure and Location of the Heart

Overview of the heart structure

The heart is a 4-chambered muscular pump made of cardiac muscle tissue.

- 4 primary muscular chambers:
  - Right atrium (RA)
  - Right ventricle (RV)
  - Left atrium (LA)
  - Left ventricle (LV)
- Connections to the great vessels:
  - Veins (bring blood back to the heart):
    - Superior and inferior vena cava (deoxygenated) → RA
    - Pulmonary veins (oxygenated) → LA
  - Arteries (carry blood away):
    - Pulmonary trunk and pulmonary arteries (deoxygenated) → from the RV
    - Aorta (oxygenated) → from the LV





Circulation of blood through the body.

Related videos

Cardiovascular System – Anatomy of the Heart

Components of the Heart – Anatomy of the Heart

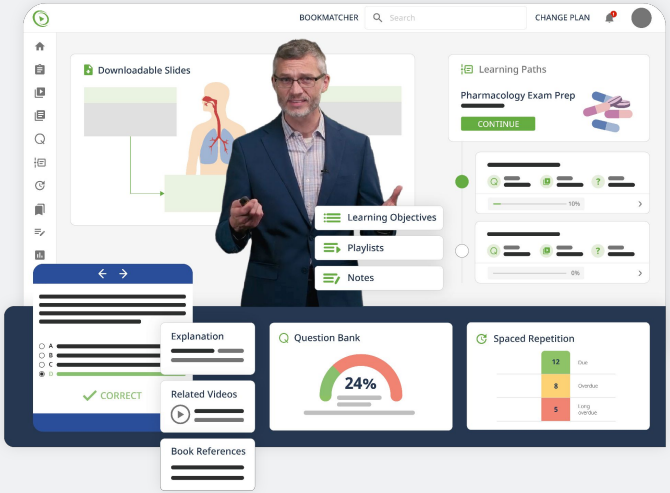
Surface Anatomy of the Heart – Heart (Cor)

The Two Sides of

Precision Health Science Teaching

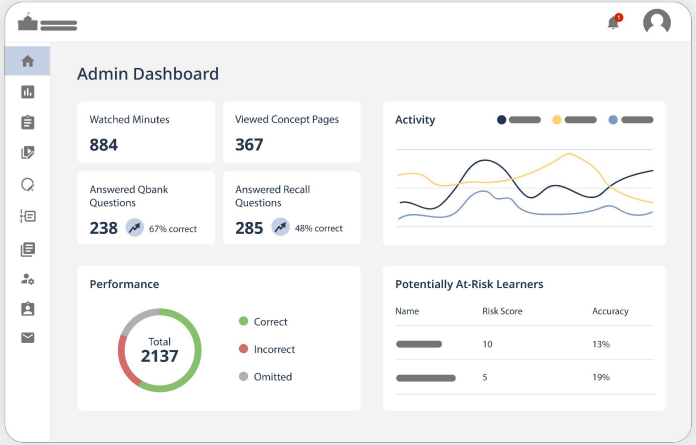
For Students

Personalized smart tutor



For Faculty

Digital teaching assistant

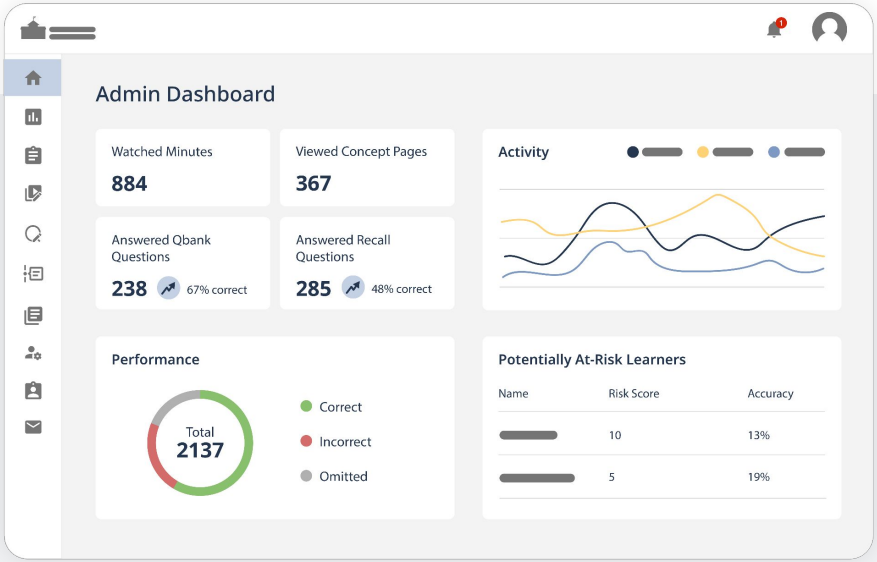


Comprehensive Tracking Enables a Comprehensive

Live Faculty Dashboard

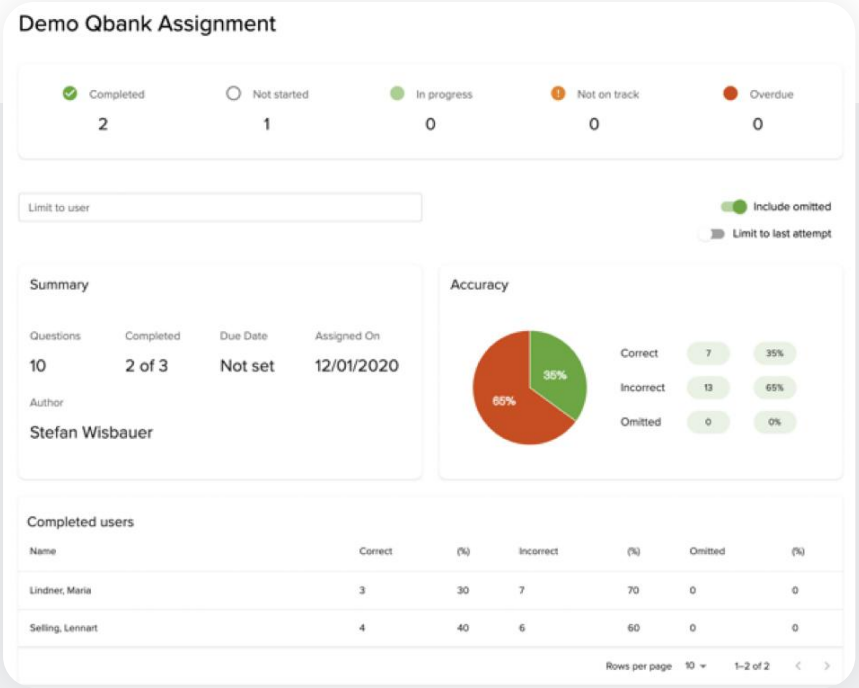
The system tracks:

- competence
- confidence
- overconfidence
- spaced repetition adherence
- mastery level
- typical mistakes
- readiness assessments



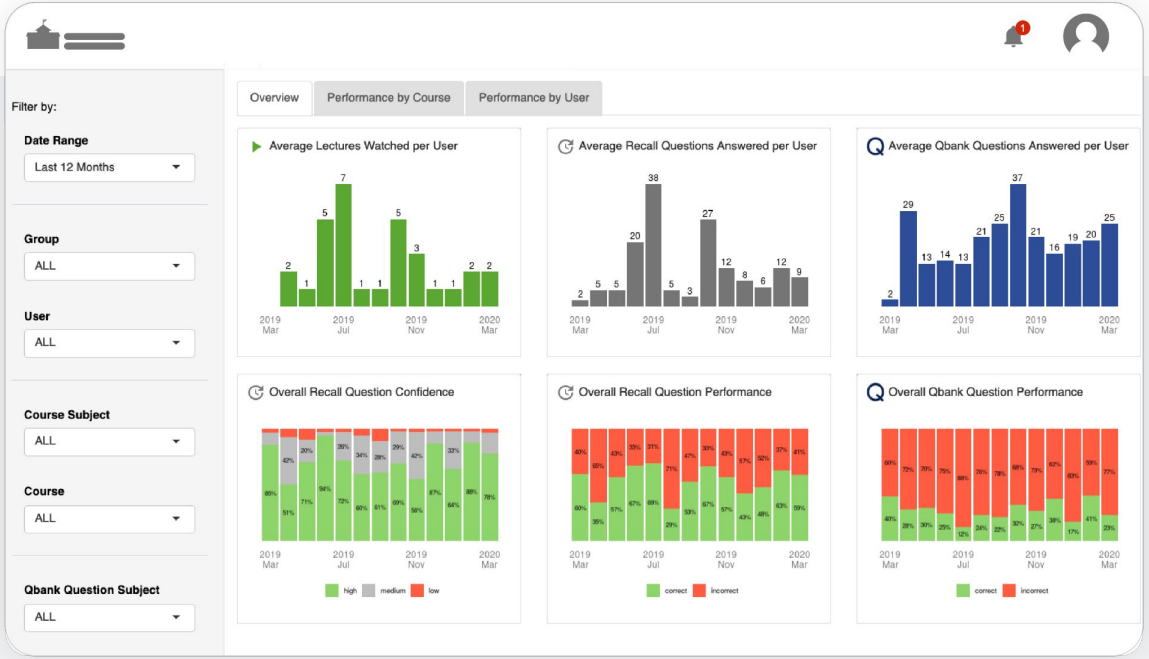
Assignment Stats

Help Focus Teaching Time on Where Students Struggle Including Typical Mistakes



Your Teaching Dashboard

Aggregate Data With Location Drill-Down on Activity, Competence, Confidence, Over-Confidence



Easy Integration With Your Existing Setup

LMS / Testing

- CANVAS
- Bb
- moodle
- SEB
- proctorio

Deep Linking
LTI SSO

Proctoring
Integrations

Session Prep:
Strengths &
Weaknesses,
Typical Mistakes

Content &
Recording
Upload

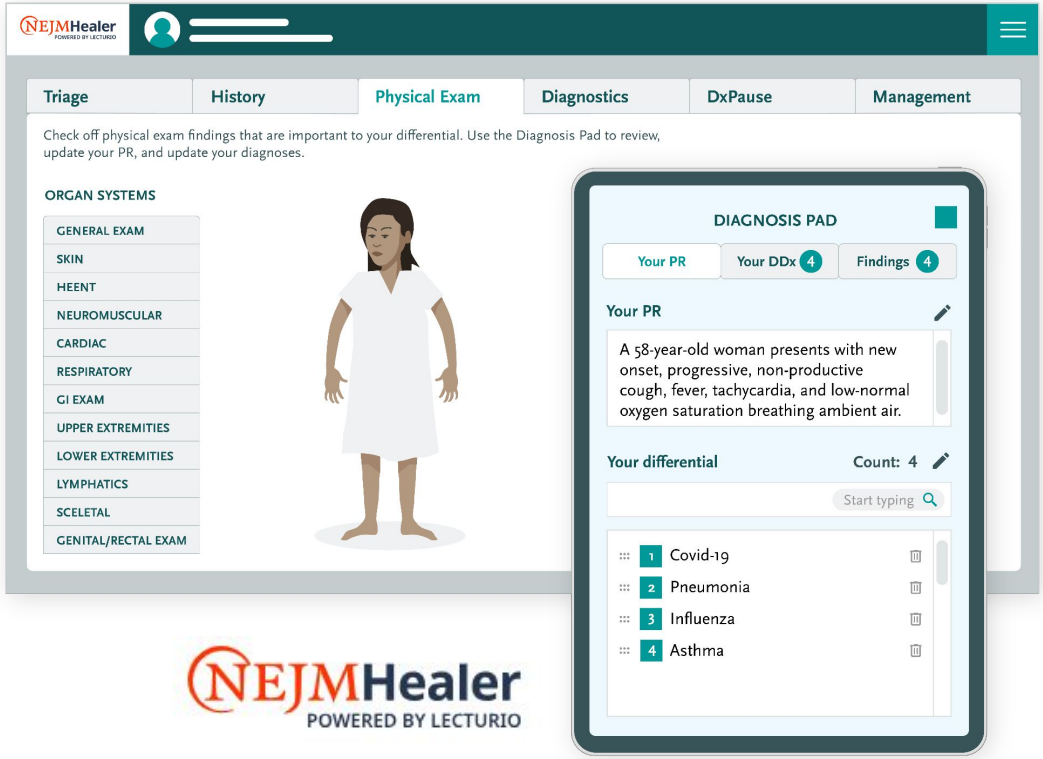
Live Teaching & Training

- Microsoft Teams
- zoom

Data Lake / Analytics

- Power BI
- R

Lecturio Acquires NEJM Healer



NEJMHealer
POWERED BY LECTURIO

Scan the QR code and learn more about NEJM Healer!

Free Online Event and Demo

Clear the Clutter

Cognitive load theory - tips for health professions educators

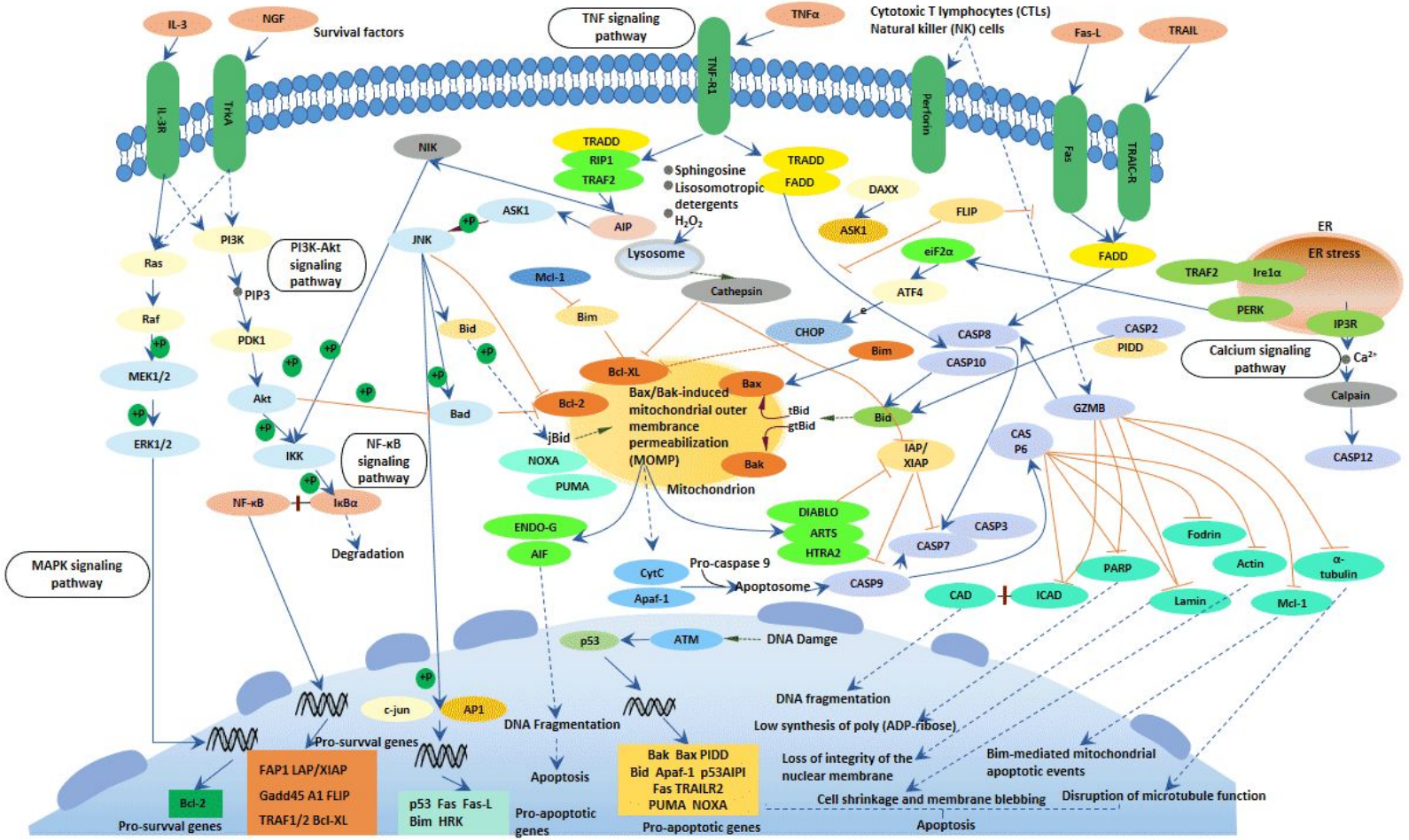
lecturio

Poll

Are you familiar with Cognitive Load Theory?

Question

Have you experienced cognitive overload?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Cathepsin
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FADD
DAXX
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Bak
tBid
gtBid
jBid
NOXA
PUMA
Mitochondrion
GZMB
CAS P6
IAP/ XIAP
DIABLO
ARTS
HTRA2
CASP3
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Apoptosome
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Bak Bax PIDD
Bid Apaf-1 p53AIPI
Fas TRAILR2
PUMA NOXA
Pro-apoptotic genes

“Please perform a comprehensive geriatric assessment on this lady”

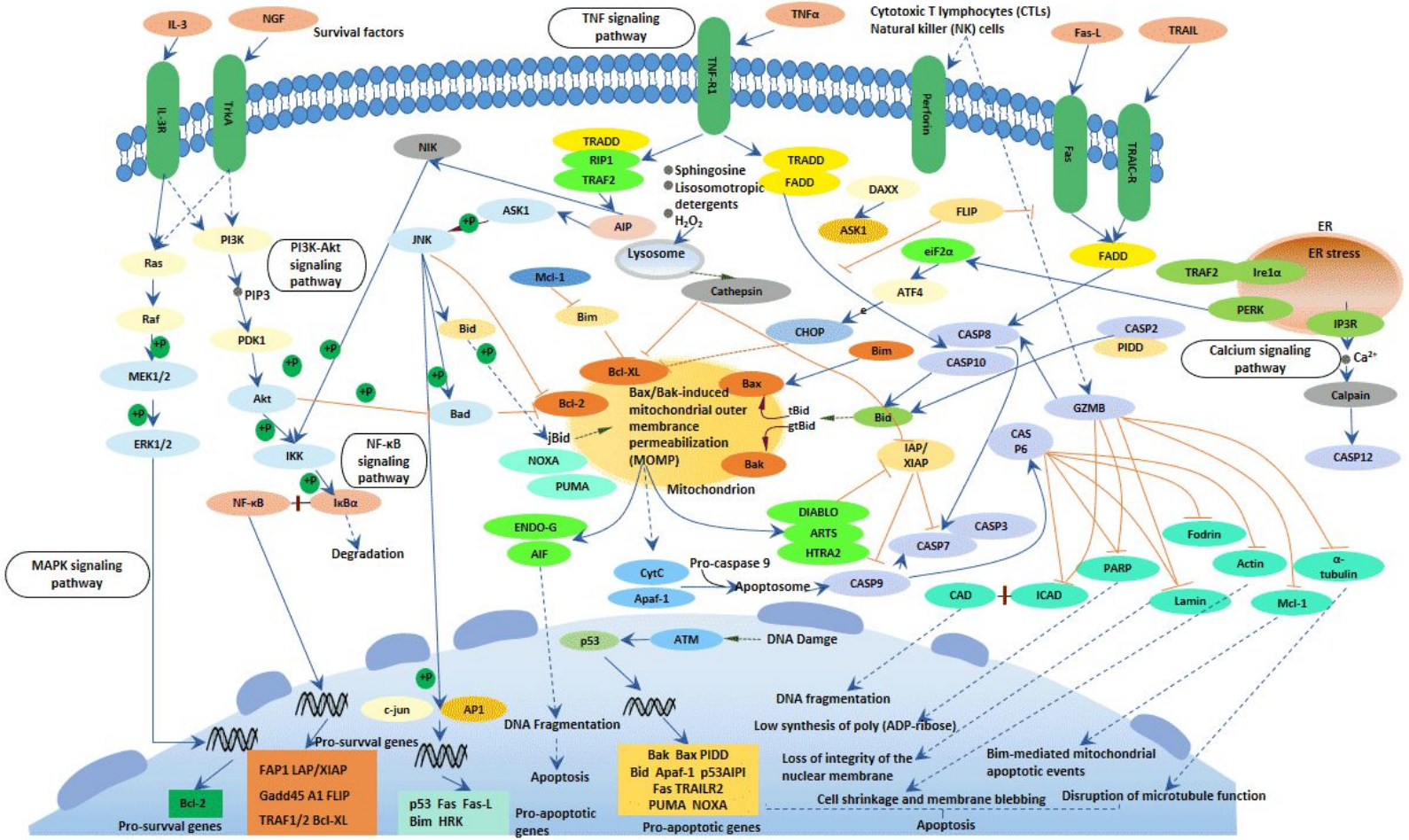
“Set up a syringe driver on this patient who is at the end of his life”

“Take a history”

“What is the difference between Type 1 and Type 2 diabetes”

What is Cognitive Load?

Amount of mental effort used to process information or perform tasks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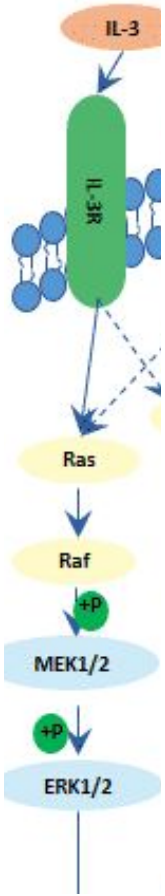
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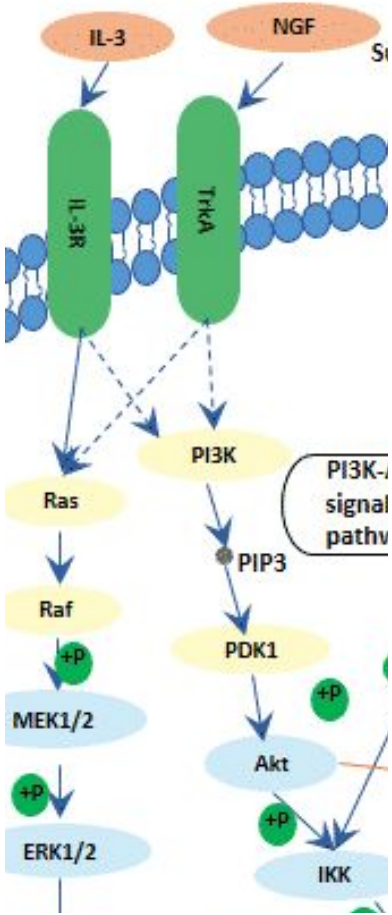
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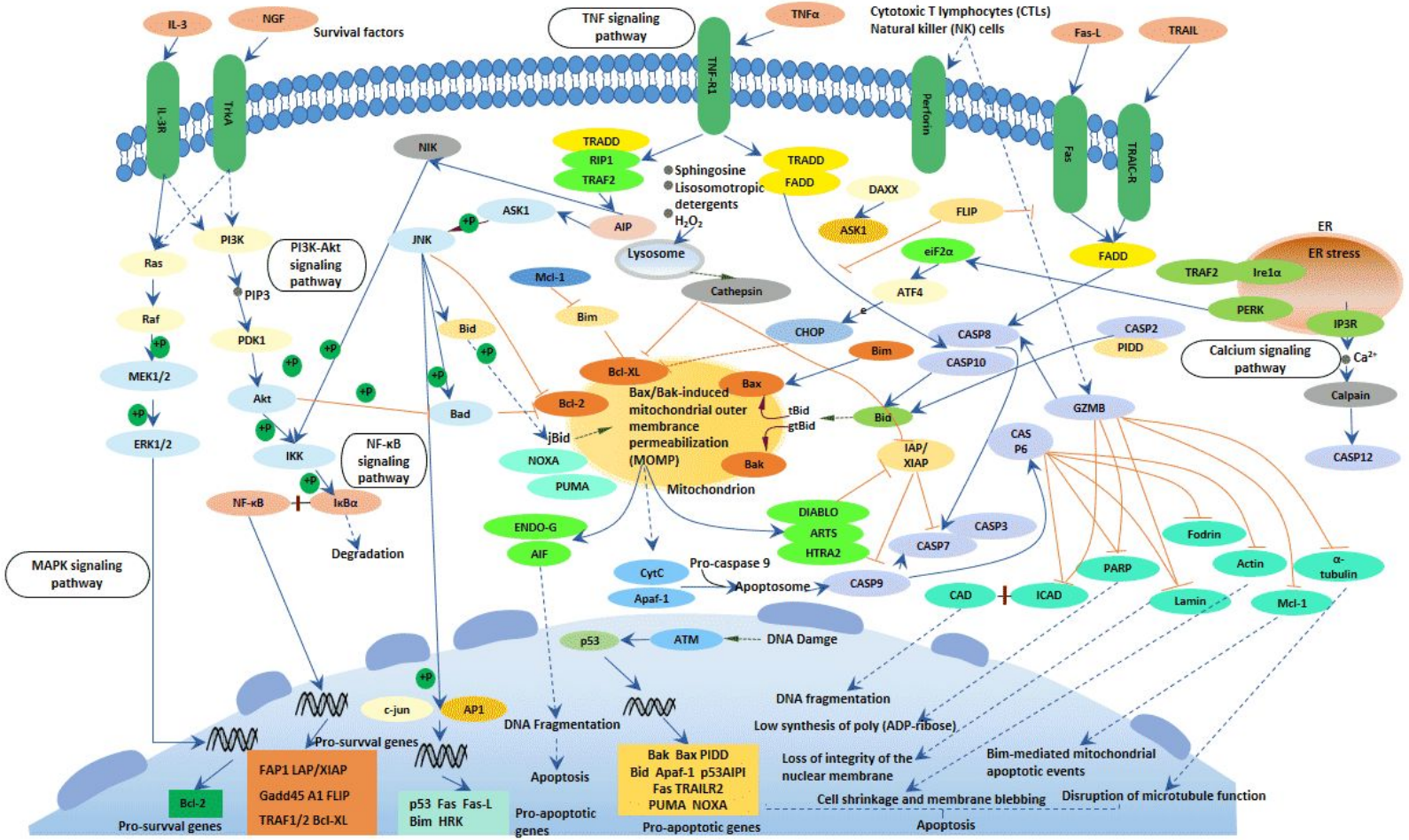
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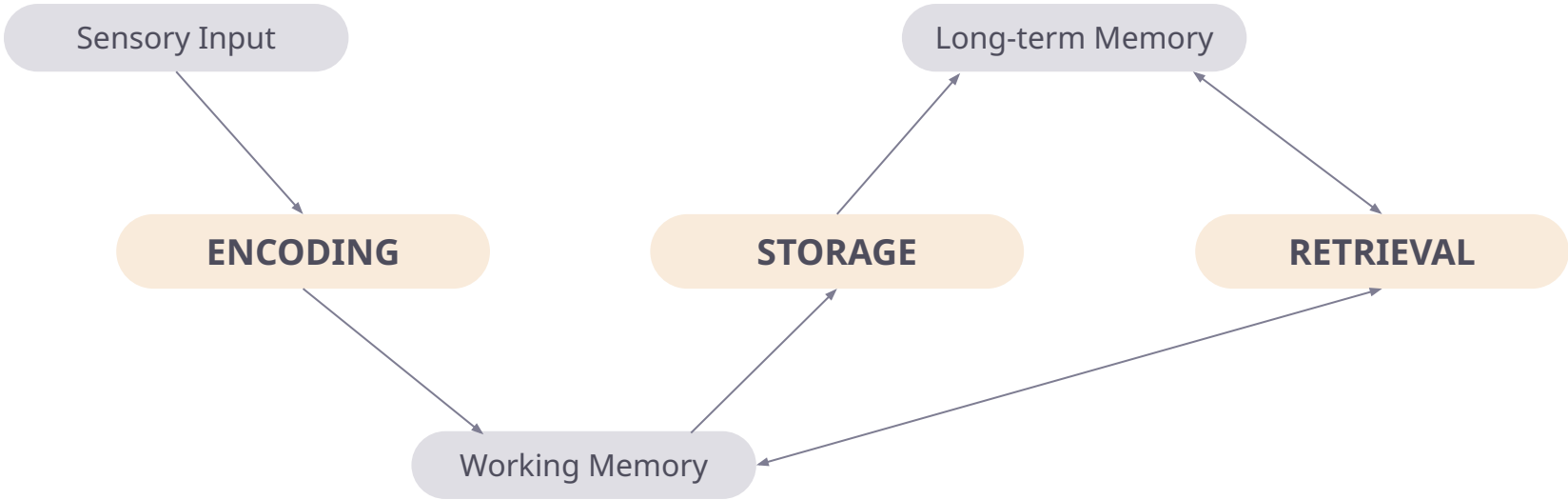
Memory


Sensory Input
Long-term Memory
ENCODING
STORAGE
RETRIEVAL
Working Memory

Strategies for Different Stages of the Memory Process

ENCODING

Initial exposure to stimulus

- Dual coding
- Semantic encoding
- Elaborative encoding

STORAGE

Maintaining information in long-term memory

- Chunking
- Mnemonics
- Concept maps

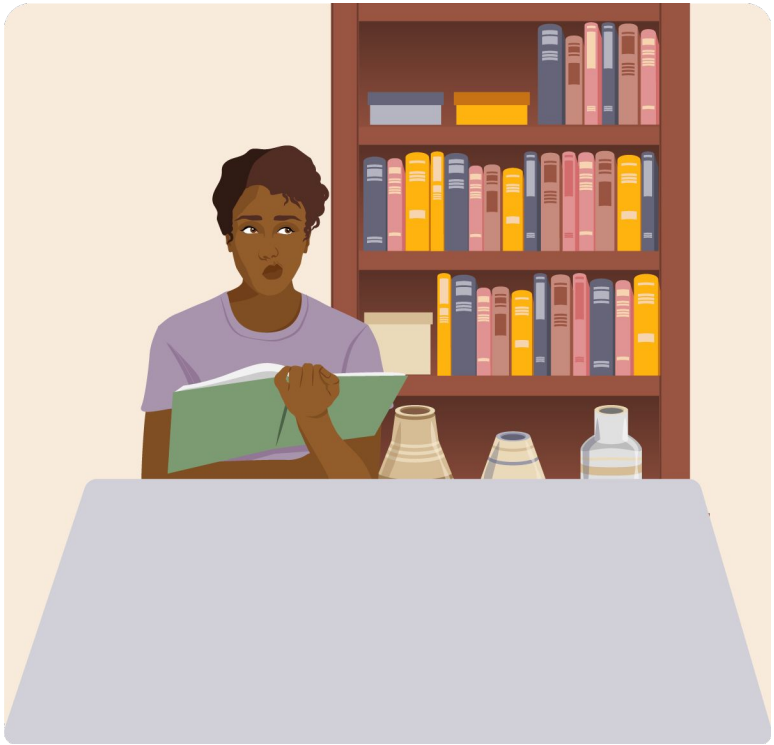
RETRIEVAL

Access and utilization of information that has been encoded and scored

- Dual coding
- Semantic encoding
- Elaborative encoding

Working Memory Has a Limited Capacity

- Holds ‘seven plus or minus two’ elements and actively processes only two to four elements at once
- Handles information for a few seconds and loses almost all information after 20 seconds unless refreshed by rehearsal
- Applies to completely novel, unorganised information



Working Memory Has a Limited Capacity

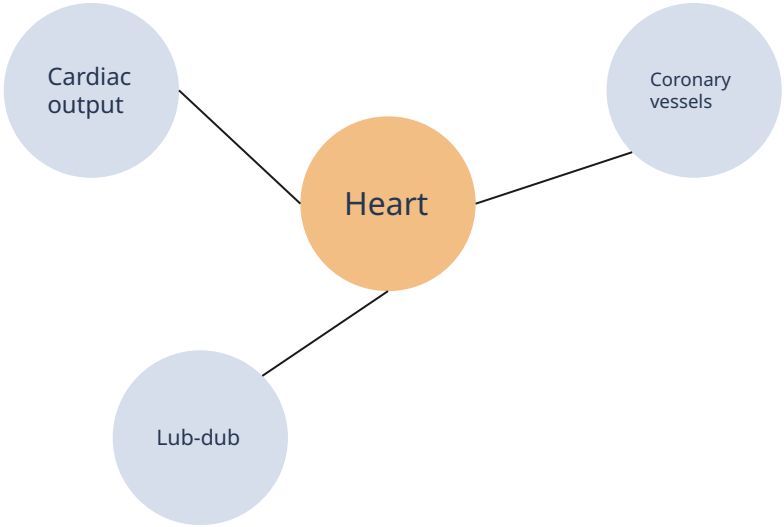
Working Memory Has a Limited Capacity

SFBICIAWHONHSCDC → S FBI CIA WHO NHS CDC

- Chest pain causes - grouping into cardiac/pulmonary/gastrointestinal/MSK/mental health
- Patient history taking - SOCRATES instead of memorising all questions
- Chunking when breaking bad news

Mental Schemas

Mental Schemas



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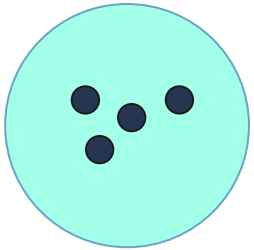

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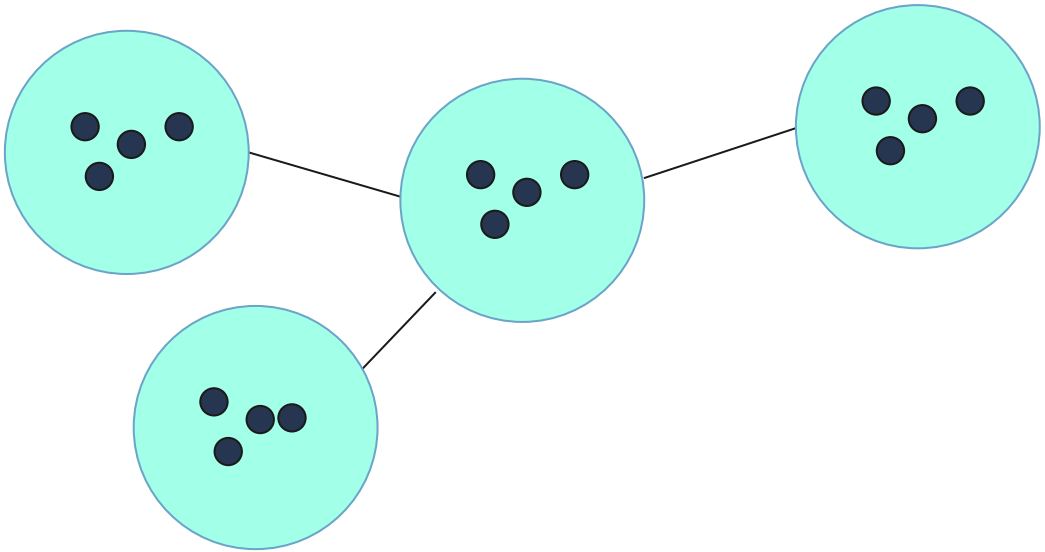
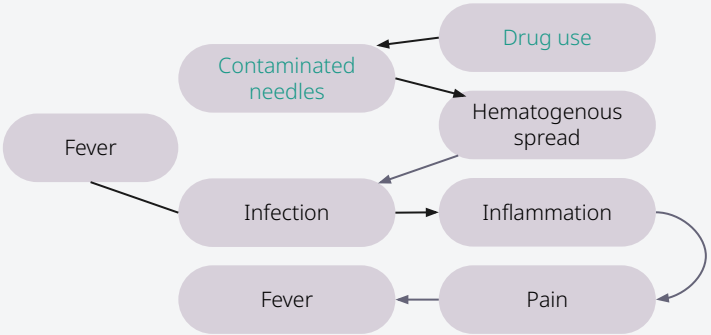
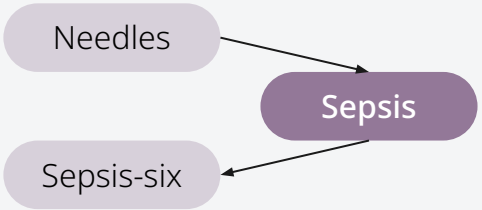


Evolution of Knowledge Structures in Medical Training

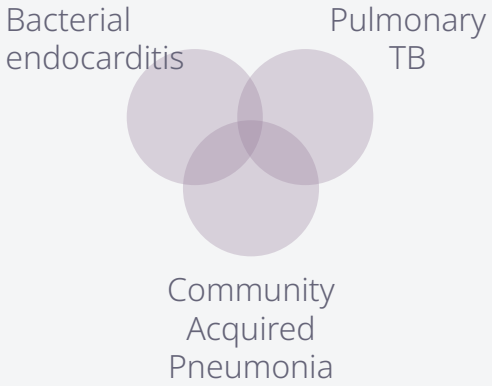
Stage 1: Causal Networks



Stage 2: Encapsulation



Stage 3: Illness Scripts



Example

Senior resident talking to a medical student about a patient who is 65 and has CKD, HTN, recent onset heart failure. He is on ACE inhibitors. Resident says his recent worsening of renal function is likely due to a combination of his HF but also the use of ACE inhibitors due to impact on renal perfusion.

Medical Student's Perspective:

The medical student, who is still mastering the basics of cardiovascular and renal physiology, struggles to keep up. They know about heart failure, kidney disease, and ACE inhibitors individually, but connecting these ideas into a coherent picture feels overwhelming. The student's cognitive load is maxed out as they try to process each piece of information and understand the complex interactions, leading to cognitive overload.

Cognitive Load Theory

Cognitive Load Theory

John Sweller, 1988

Working memory has a limited capacity to hold information at one time.

Instructional methods should avoid overloading students in order to maximize learning.

Cognitive Load Theory

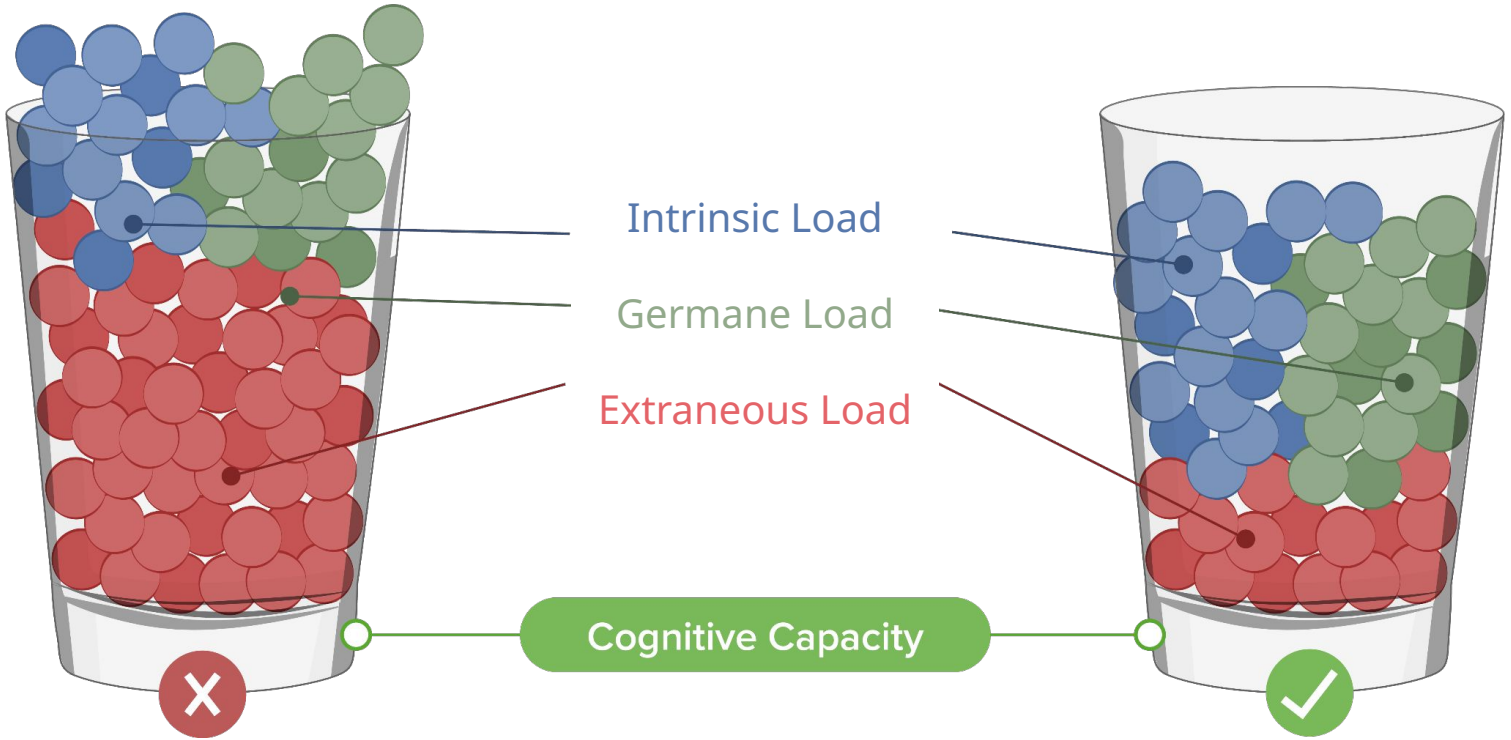
Attempts to dissect these issues and provides recommendations for instructional methods.

Types of Cognitive Load

Types of Cognitive Load

Intrinsic	The difficulty of a particular topic
Germane	Effort needed to process into long-term memory
Extrinsic	Processes not related to learning

Types of Cognitive Load



Managing Cognitive Load

Managing Cognitive Load

120/80
Normal human BP

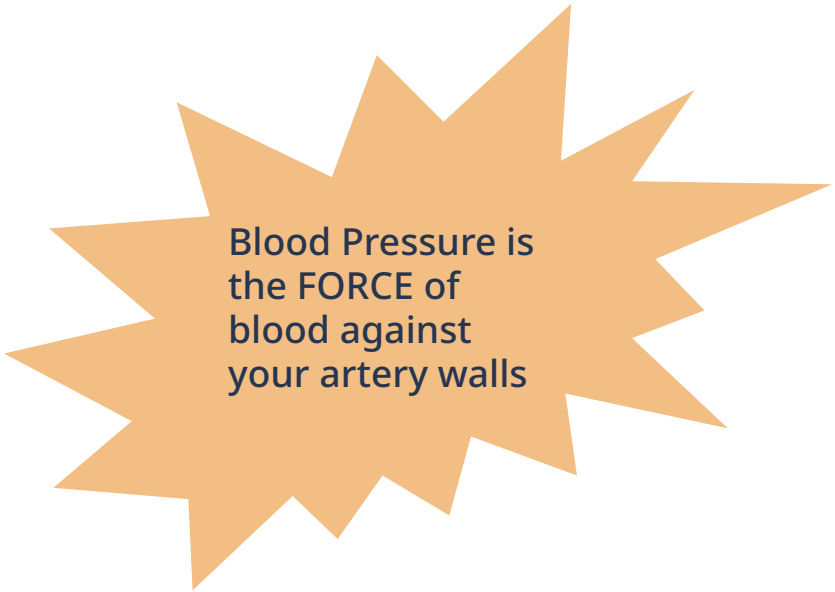
Intrinsic load Low

Extraneous load Low

Managing Cognitive Load

120/80

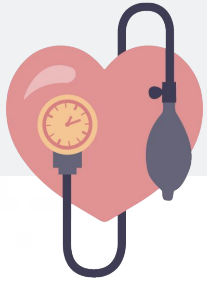
Normal human BP



Intrinsic load Low

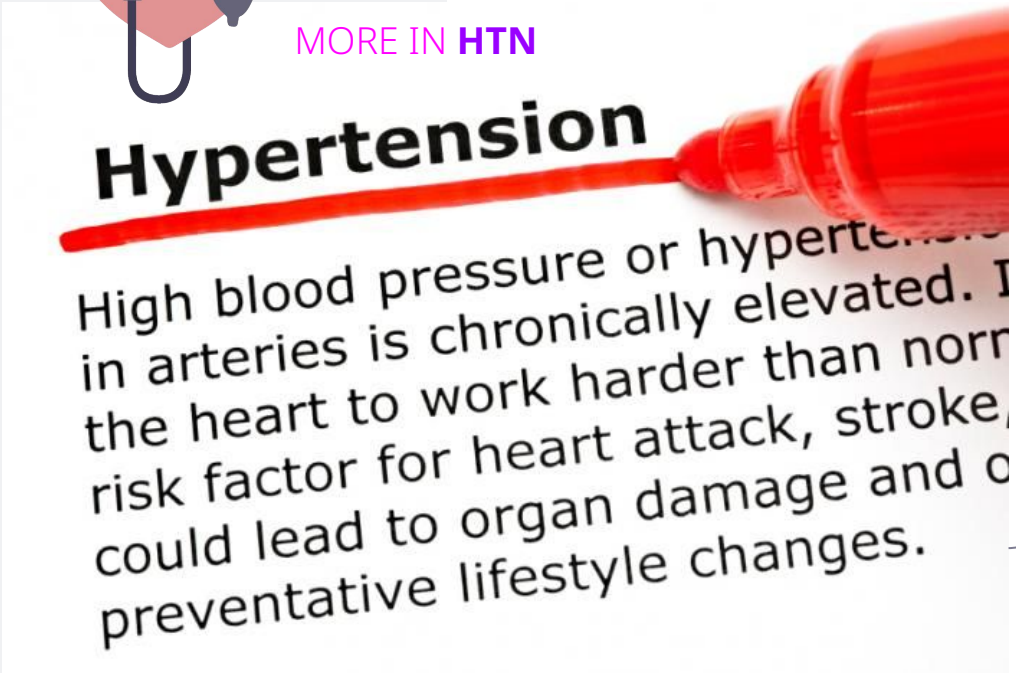
Extraneous load High

Managing Cognitive Load



120/80
Normal human BP

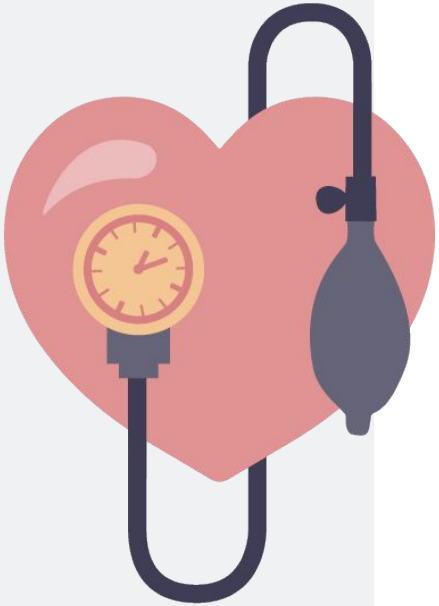
MORE IN **HTN**



Intrinsic load — Higher

Extraneous load — High

Managing Cognitive Load



120/80
Normal human BP

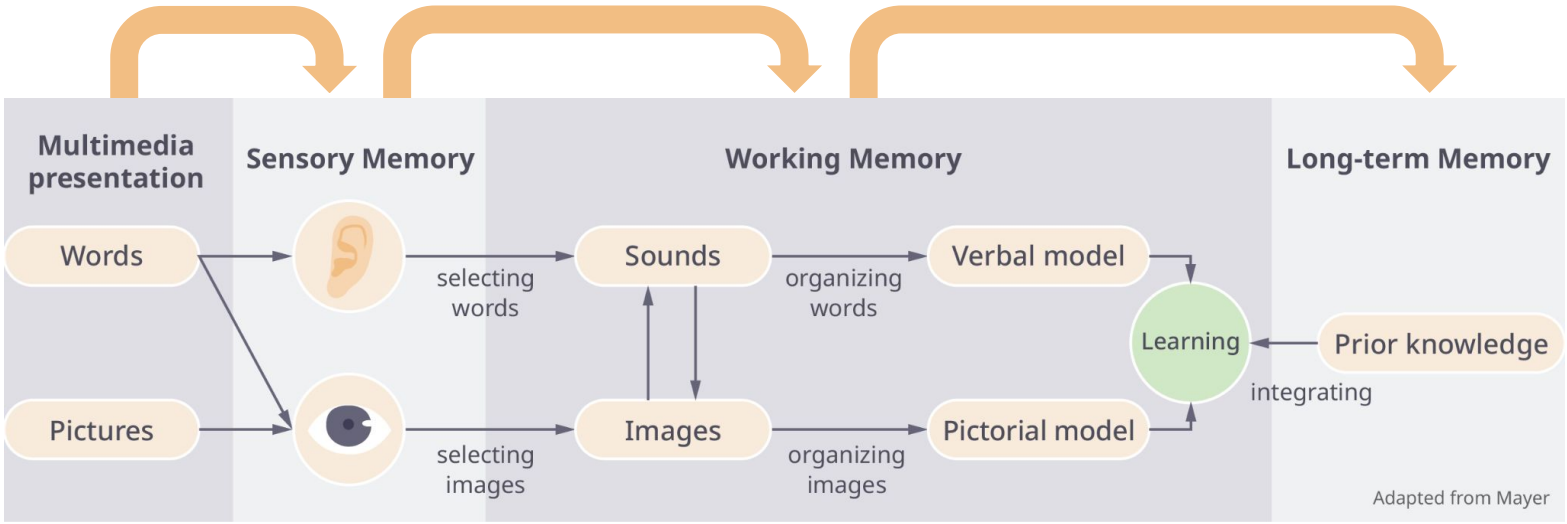
120-139
Hypertension Stage 1

>140
Hypertension stage 2

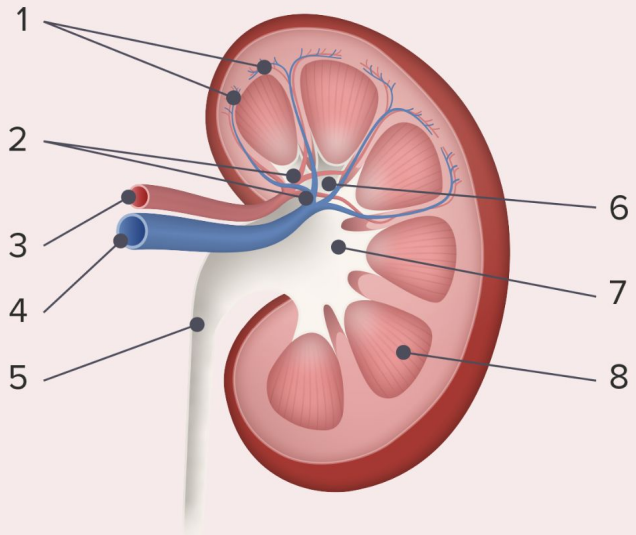
Intrinsic load — Higher

Extraneous load — Low

Mayer's Cognitive Theory



Kidney Anatomy



1. cortical blood vessels
2. interlobular blood vessel
3. renal artery
4. renal vein
5. ureter
6. minor calyx
7. major calyx
8. medula

Facts

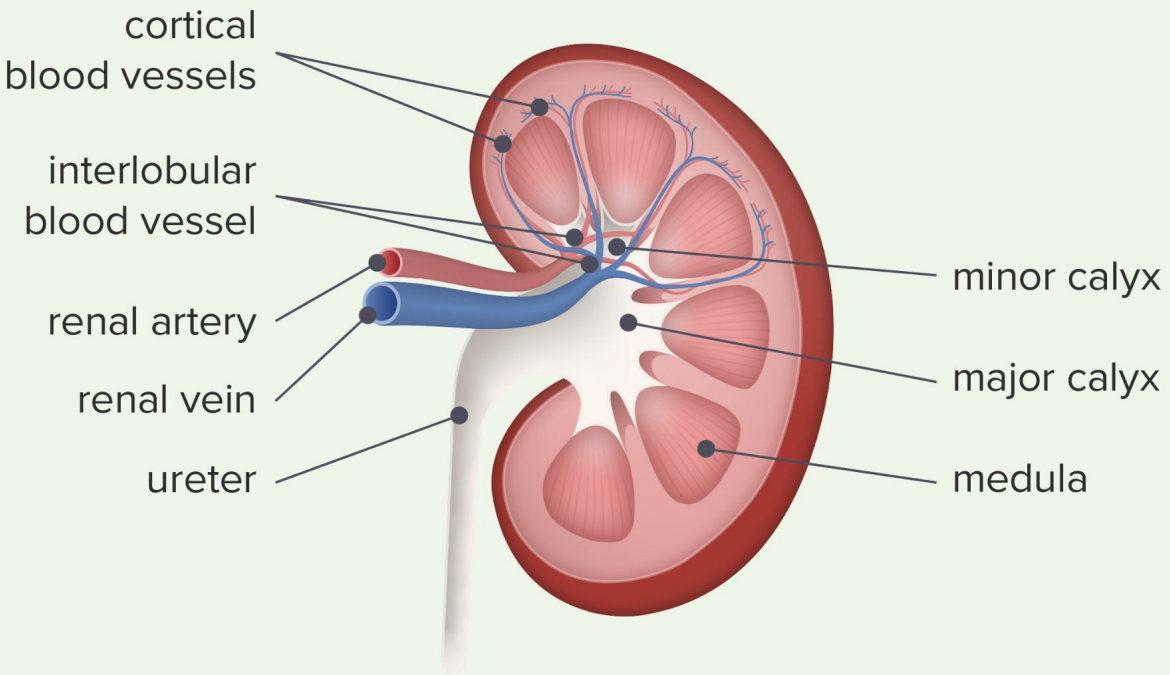
Kidneys filter 120-150 quarts of blood daily.

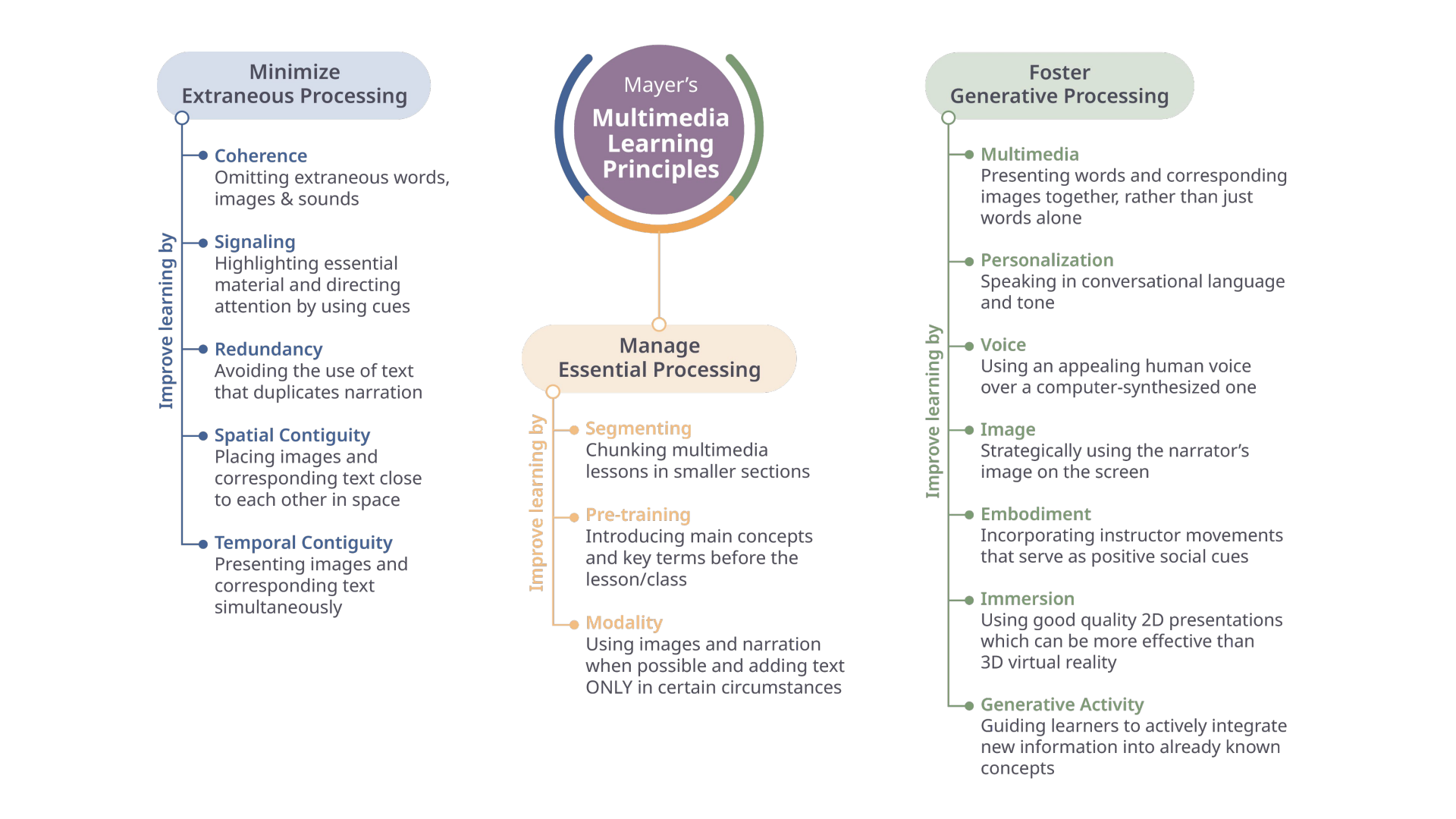
Kidneys remove waste from the body

Kidneys maintain a constant amount of fluid in the body.

Kidneys maintain electrolyte levels.

Kidney Anatomy




Mayer's
Multimedia Learning Principles
Minimize Extraneous Processing
Improve learning by
Coherence
Omitting extraneous words, images & sounds
Signaling
Highlighting essential material and directing attention by using cues
Redundancy
Avoiding the use of text that duplicates narration
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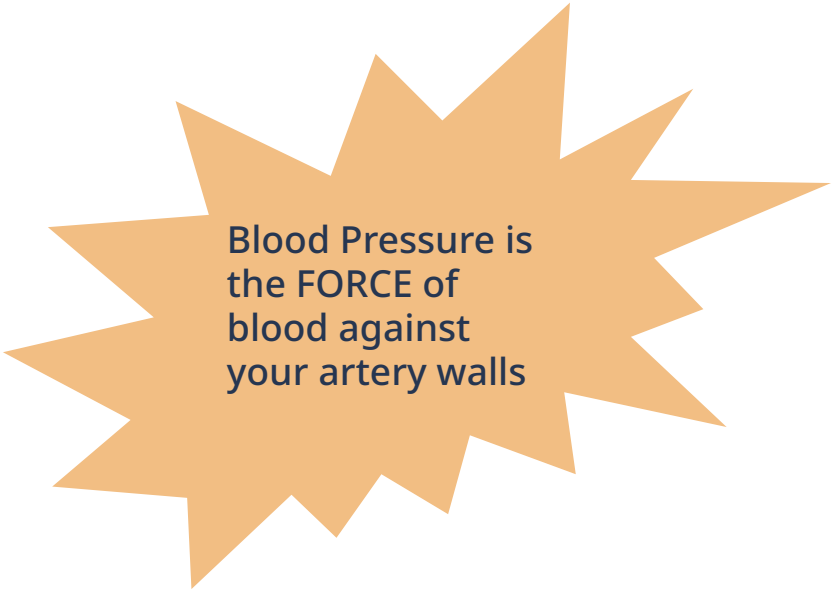


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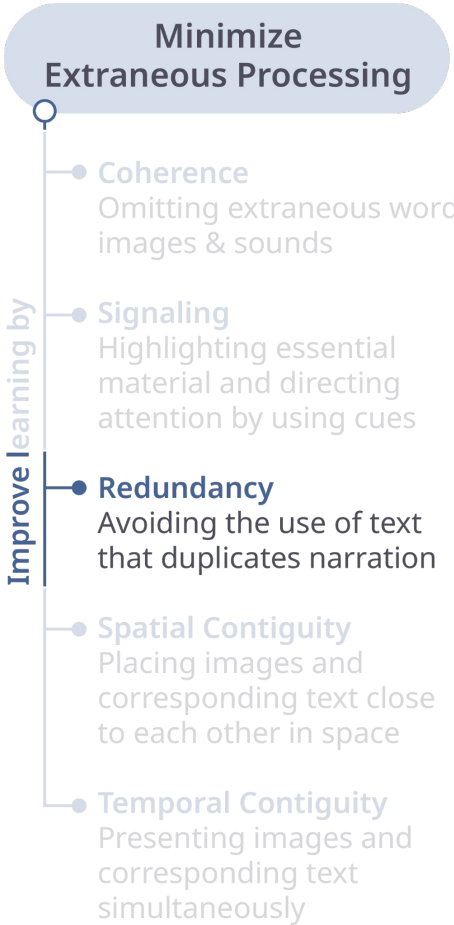

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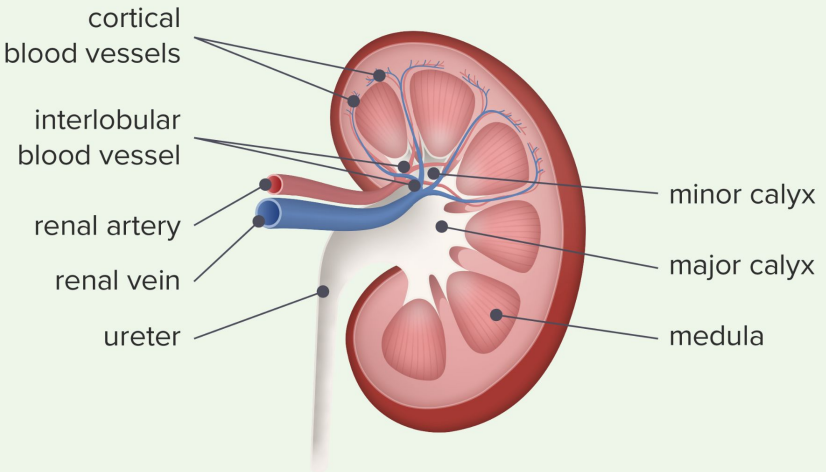

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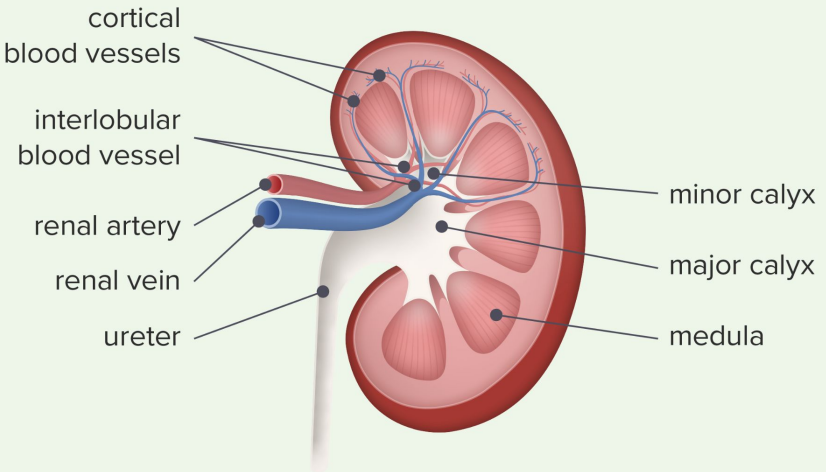

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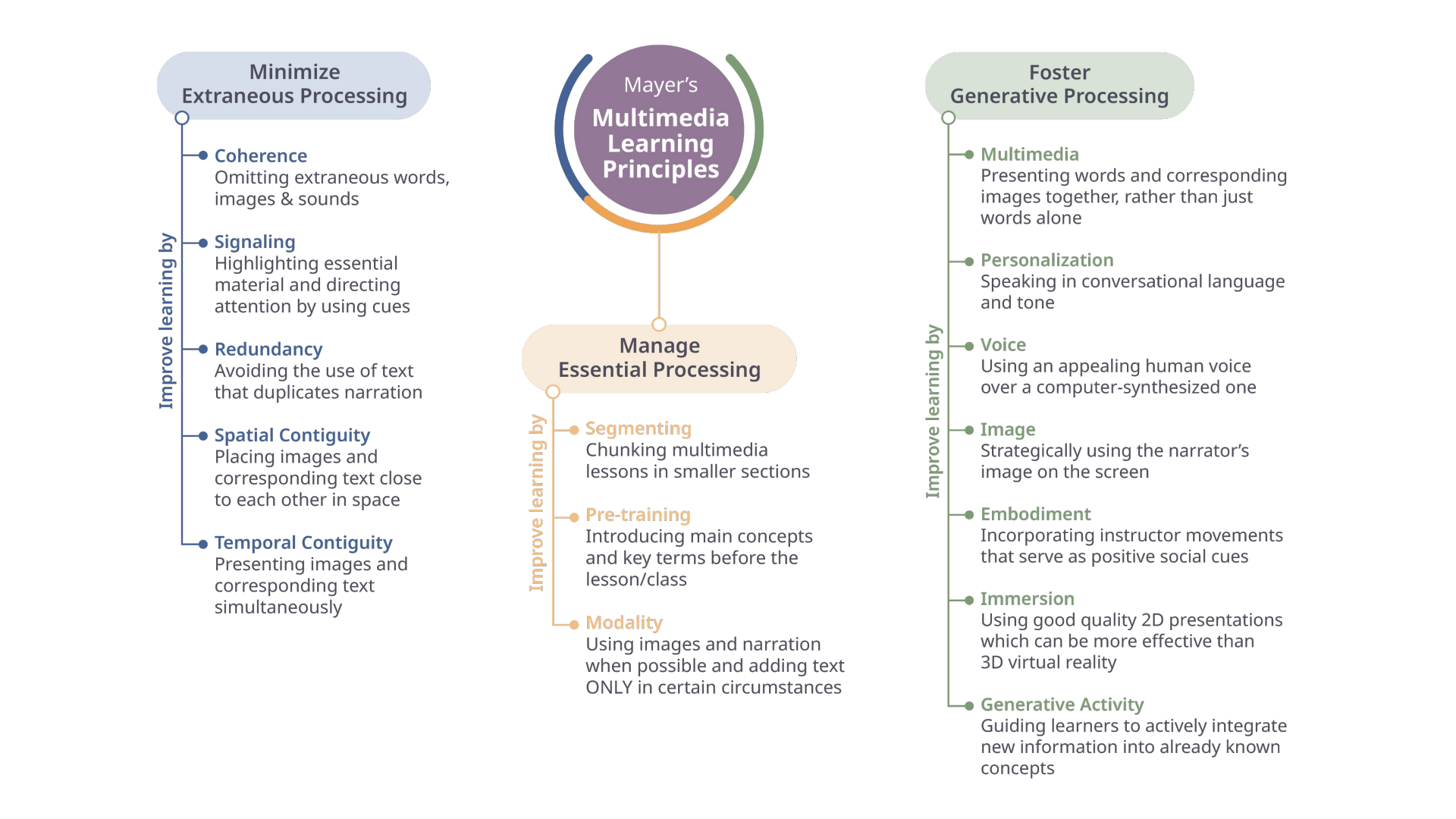
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Managing Cognitive Load

Beyond multimedia learning

cognitive load theory

Cognitive load theory in health professional education: design principles and strategies

Jeroen J G van Merriënboer[1,2] & John Sweller[3]

Managing intrinsic load

Optimising germane load

Decreasing extraneous load

Decreasing Extraneous Load

Goal-free principle

“What is the correct diagnosis?”

“What are the possible diagnoses?”

Decreasing Extraneous Load

Worked example principle

“See the patient and come up with a treatment plan”

“What do you think of this treatment plan?”

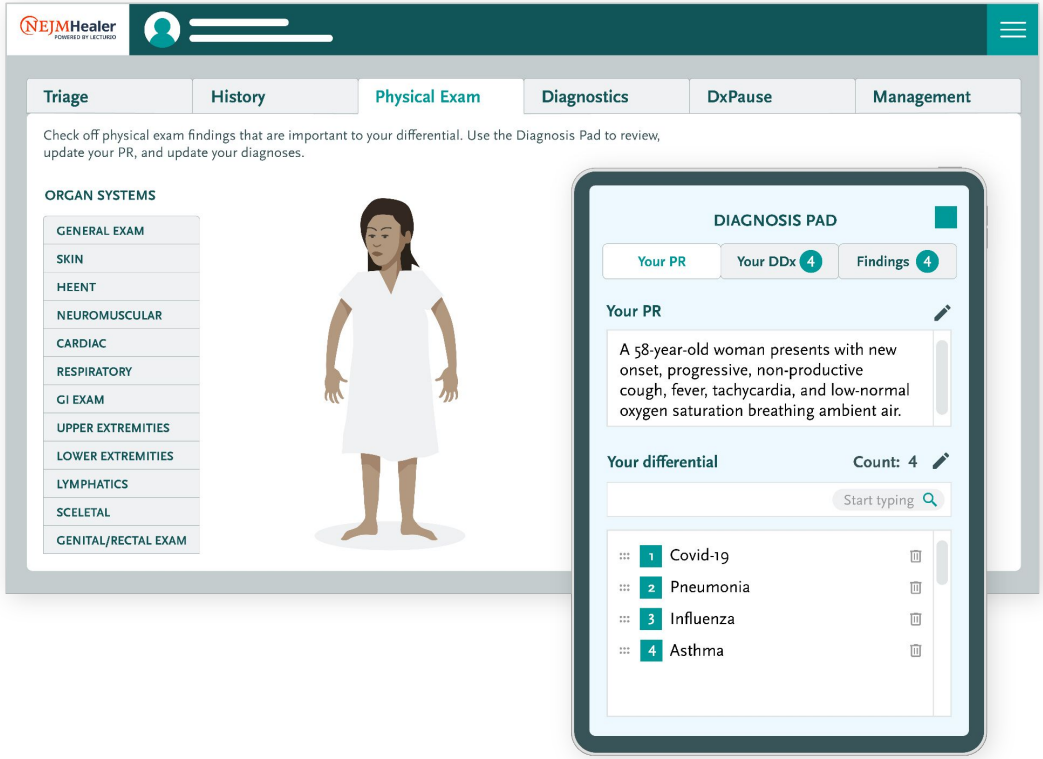
Decreasing Extraneous Load

Completion principle

"See the patient and come up with a treatment plan"

"See the patient and come up with a differential diagnosis"

Decreasing Extraneous Load



Completion principle

Decreasing Extraneous Load

Split attention principle

Managing Intrinsic Load

Simple-to-complex

Which of the following is a symptom of hypertension?

A 50-year old patient comes in with chest pain...

Element interactivity

Managing Intrinsic Load

Low-to-high fidelity

Text-based problems

Real life patient interaction

Optimizing Germane Load

“Desirable difficulty”

Variability principle

Contextual interference

Optimizing Germane Load

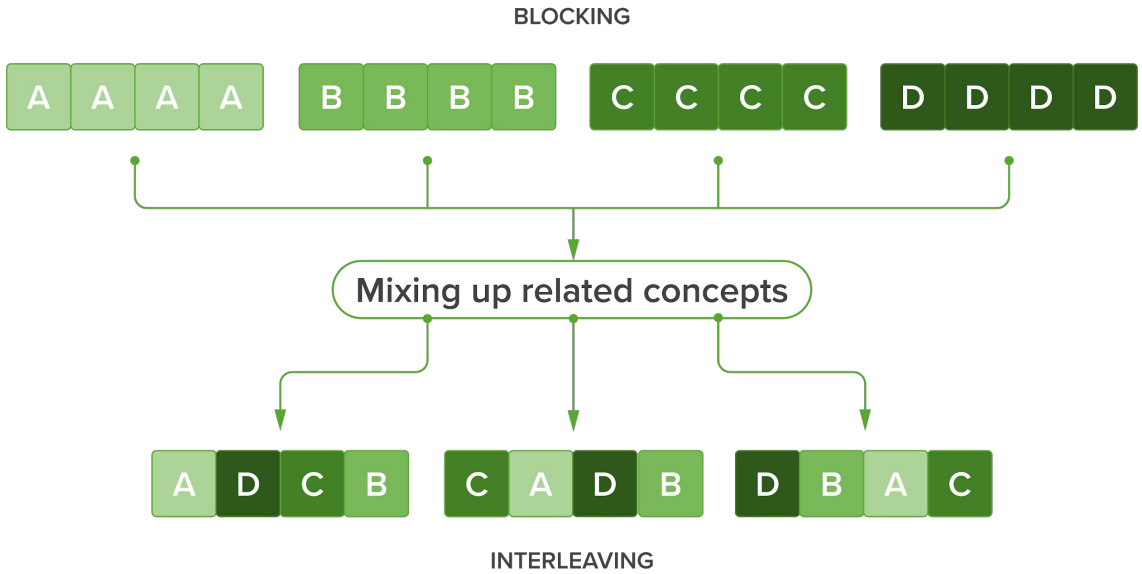
Variability principle

- Apply concepts through different contexts
- Encourages learners to construct cognitive schemas
- When discussing hyponatremia, use cases of different etiologies: hypovolemic patient, SIADH, heart failure, etc.
- Helps learners determine the range of applicability of constructed schemas

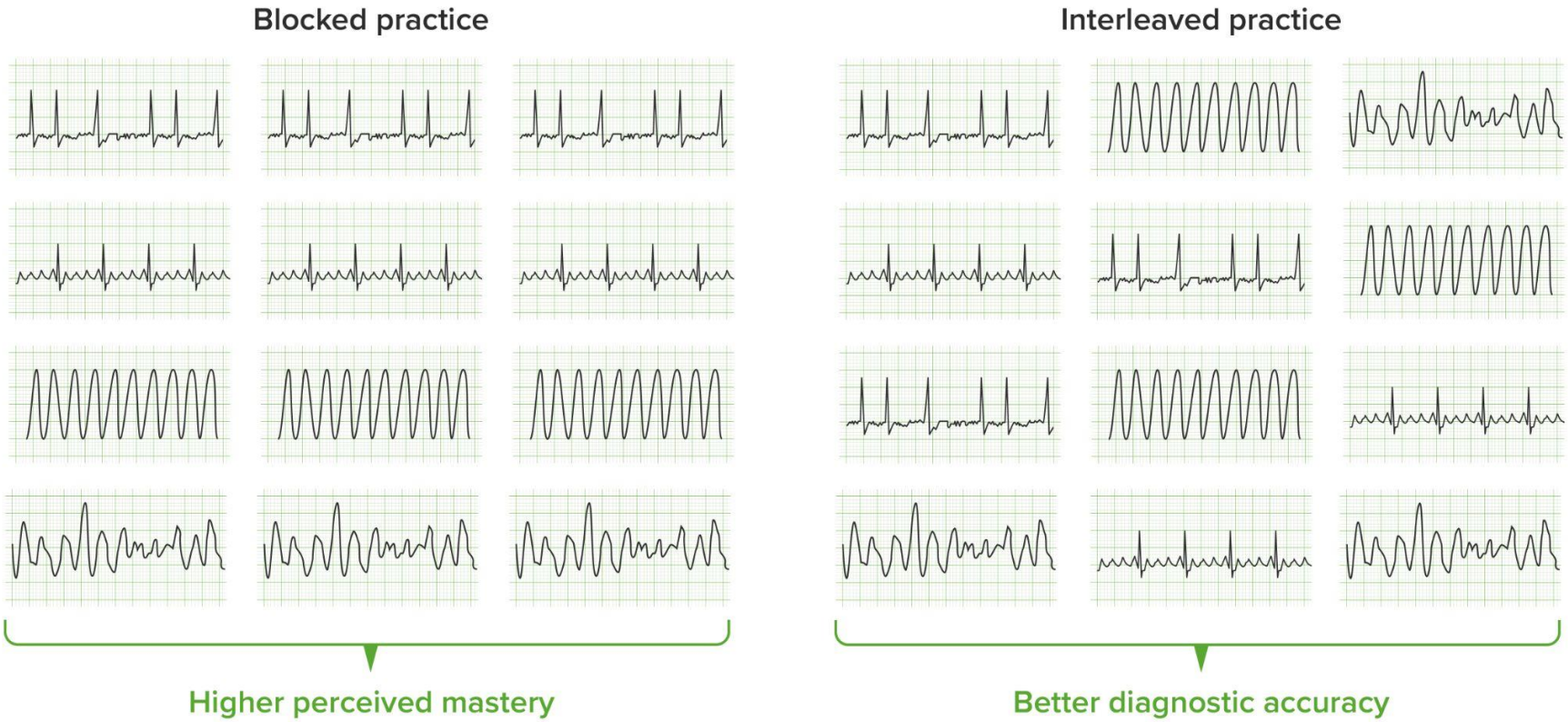
Optimizing Germane Load

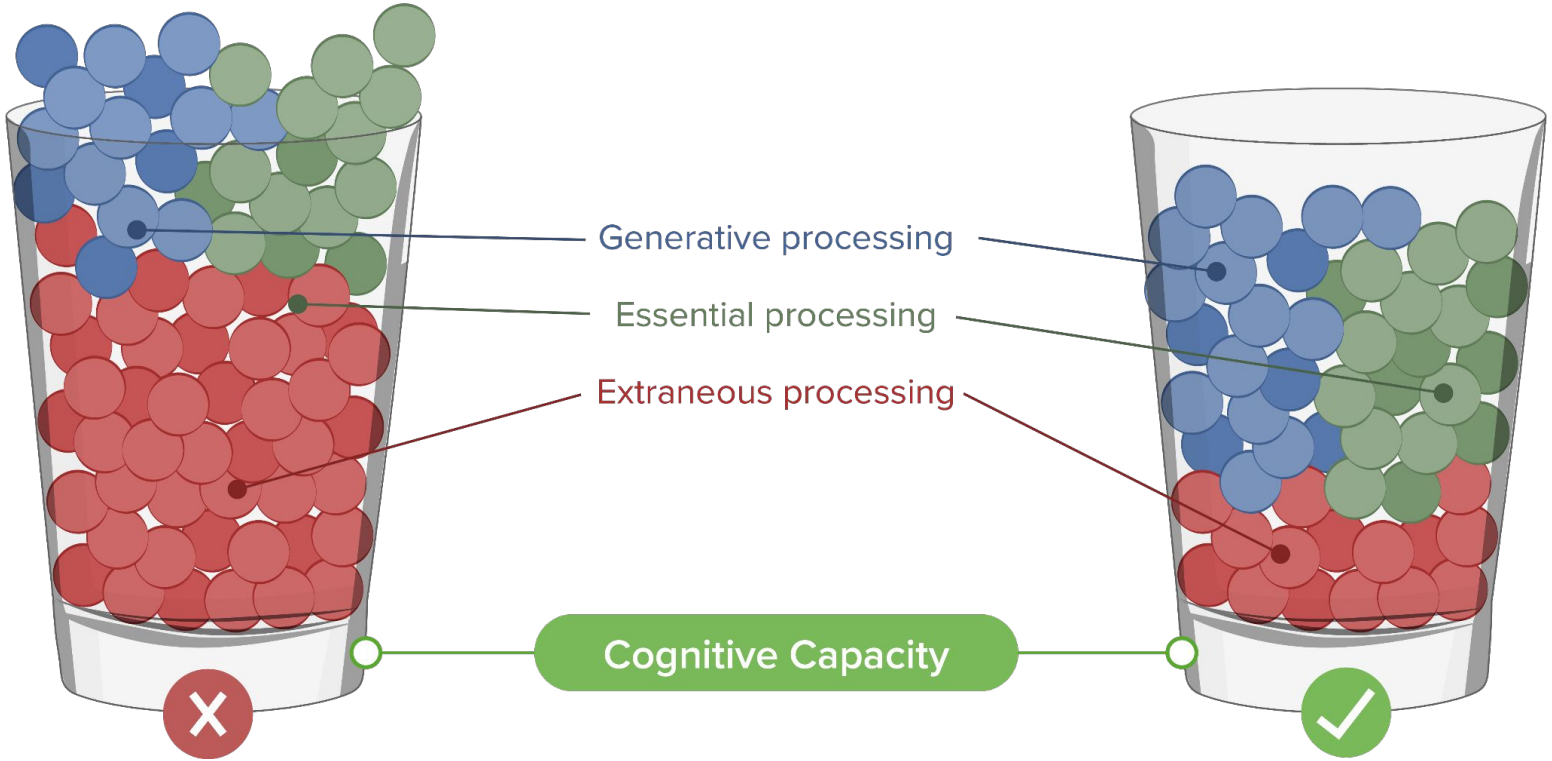
Contextual interference

Interleaving



Optimizing Germane Load



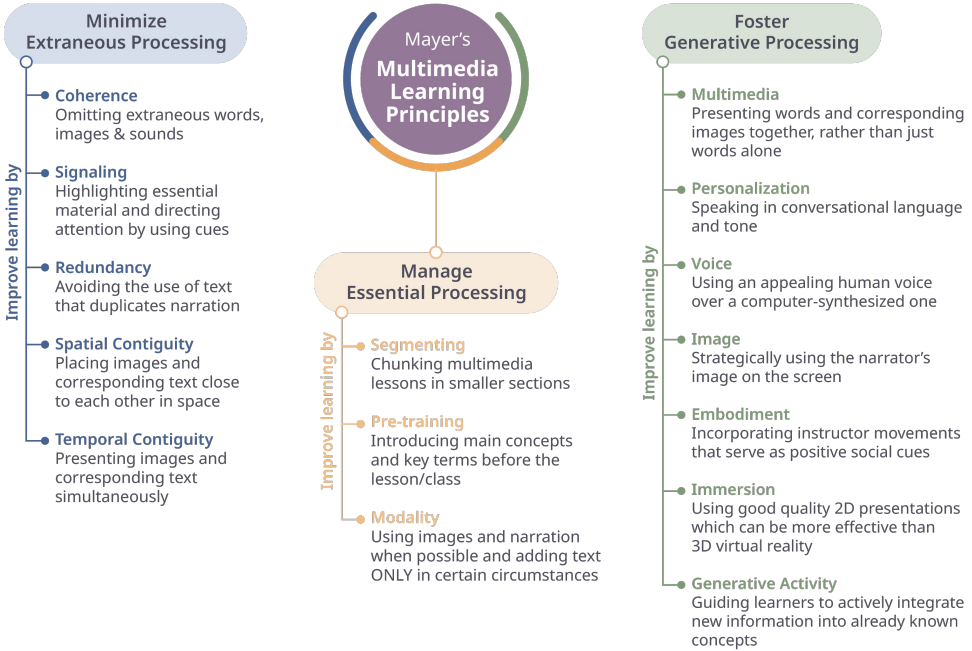

Generative processing
Essential processing
Extraneous processing
Cognitive Capacity

Cognitive Load Theory in different Contexts

Instructional methods

- Decrease **extraneous** load
  - Goal-free principle
  - Completion principle
  - Split-attention principle
- Manage **intrinsic** load
  - Simple-to-complex
  - Low-to-high fidelity
- Optimize **germane** load
  - Variability principle
  - Contextual interference

Educational tools



Practical Considerations

- What is the best way to deliver certain content? Is it a presentation?
- Other factors for effective presentations
  - 5/5/5 rule
  - Short presentations
- Remember your choice of delivery must be aligned with your objectives (not too many objectives!)
- Optimise germane load by utilizing principles of active learning
  - Quizzes
  - Discussion
  - Group work
- Regardless of how you are currently doing things, there is always room for improvement

Questions

Are you maximizing your students' intrinsic cognitive load?

What is one thing you can do to decrease extraneous cognitive load?

What is one strategy you will use to foster germane load?

Are You Interested in Our Future Events?

Learning Science Webinar:

Preparing Your Students for Exam Success

Louise Jones, PhD, MEd

Thursday, September 12

Scan the QR code to register!

Contact us!

Lecturio Partnership Team
institutions@lecturio.com