

Signal and Noise

Understanding Cognitive Load in
Medical Education



Jonathan Berry

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Disclosures

GenAI tools (Gemini, NotebookLM, Claude, Claude Code) were used for the generation of teaching materials, including slides and graphics.

Don't worry – I will show you how!

All information being presented was edited and reviewed for accuracy by the presenters.

**Knowing nothing else about the speaker or topic,
would you rather attend a medical lecture that is
a PowerPoint or a “Chalk Talk”?**



PowerPoint



Chalk Talk

Knowing nothing else about the topic, would you rather *give* a medical lecture that is a PowerPoint or a “Chalk Talk”?

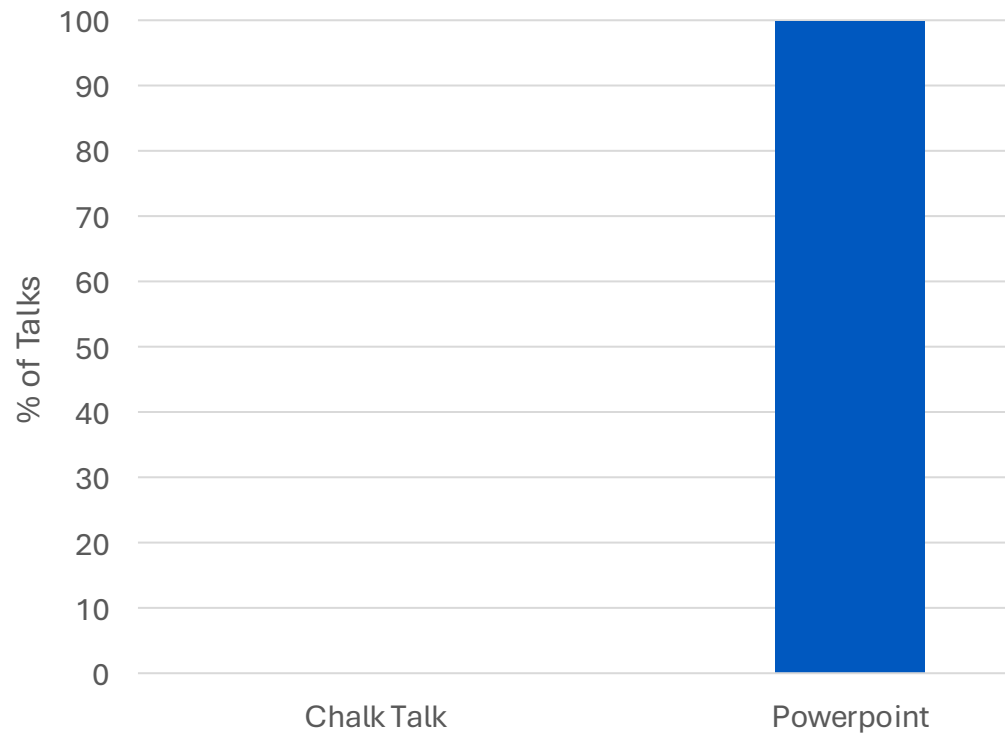


PowerPoint



Chalk Talk

Quantitative Study of the Characteristics of Effective Internal Medicine Noon Conference Presentations





CHALK TALK	POWERPOINT

EDUCATIONAL PSYCHOLOGIST, 38(1), 43–52
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Nine Ways to Reduce Cognitive Load in Multimedia Learning

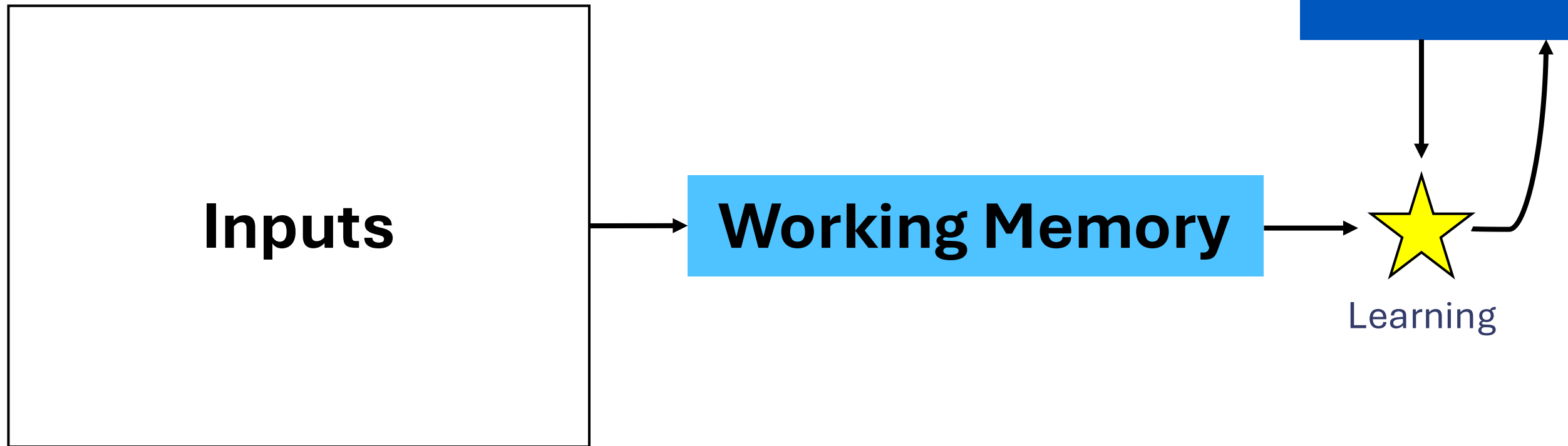
Richard E. Mayer

*Department of Psychology
University of California, Santa Barbara*

Roxana Moreno

*Educational Psychology Program
University of New Mexico*

Active Processing



Dual Channel

Music Speech Sounds
↓ ↓ ↓
Auditory

Text Graphics
↓ ↓
Visual



Limited Capacity

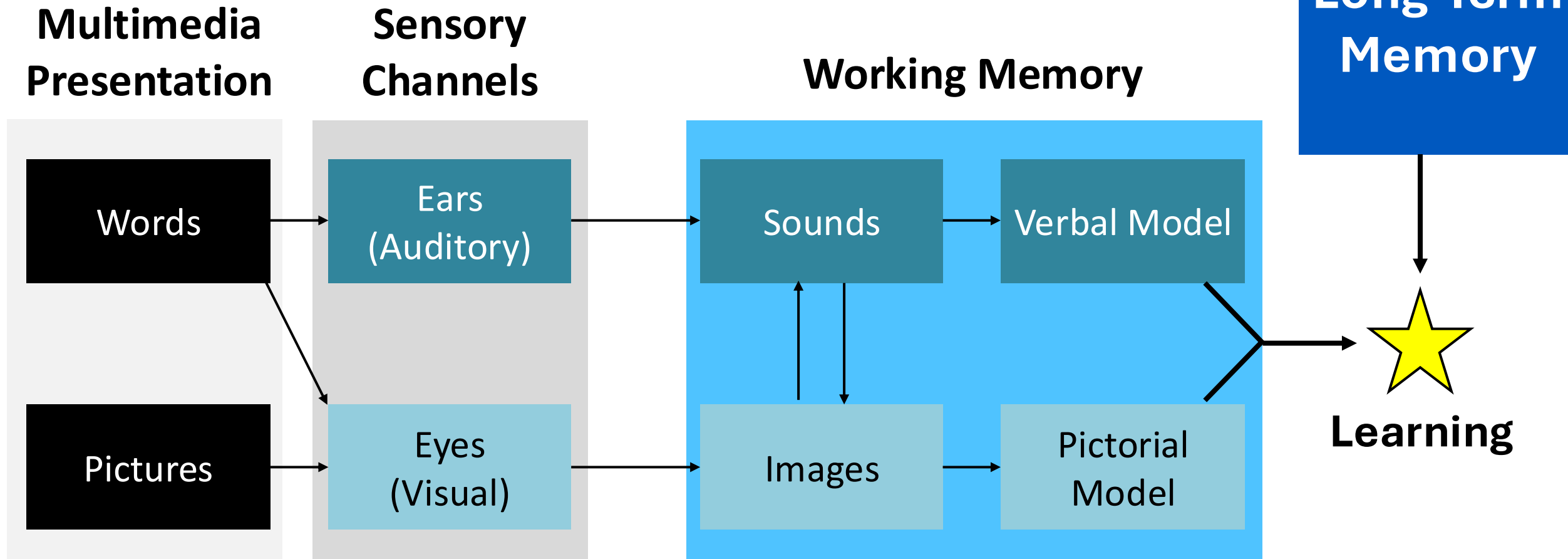
Music Speech Sounds
↓ ↓ ↓
Auditory



Text Graphics
↓ ↓
Visual



Active Processing



Adapted from Meyer. MedEd. 2010.

EDUCATIONAL PSYCHOLOGIST, 38(1), 43–52
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Nine Ways to Reduce Cognitive Load in Multimedia Learning

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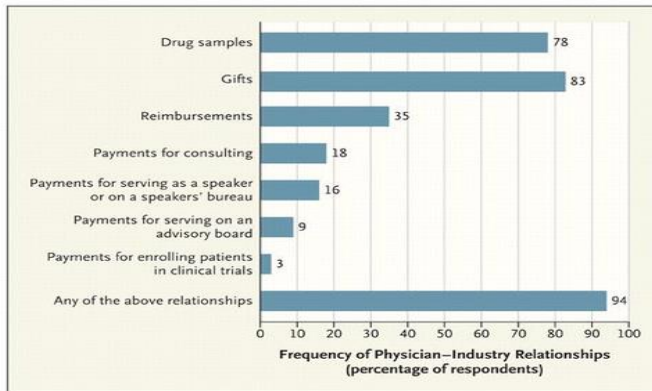
*Department of Psychology
University of California, Santa Barbara*

Roxana Moreno

*Educational Psychology Program
University of New Mexico*

Simplified

Choose 2



1

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed diam nonummy nibh euismod tincidunt ut laoreet dolore magna aliquam erat volutpat. Ut

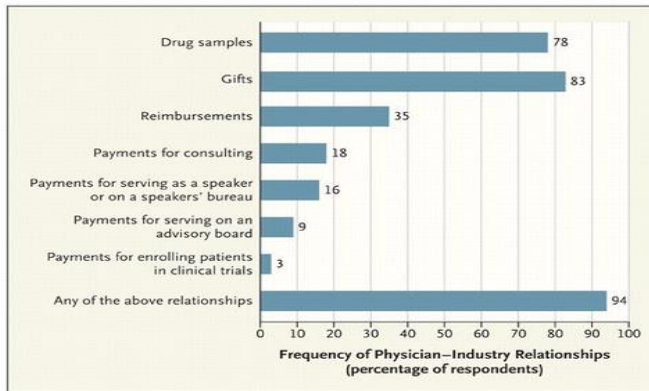
2



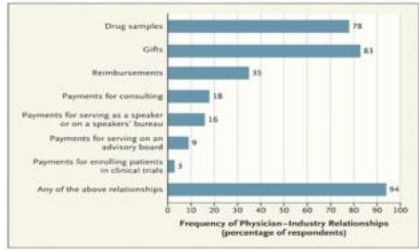
3



Choose 2

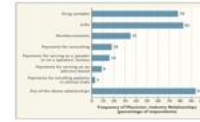


Choose 2



Next animation

Choose 2



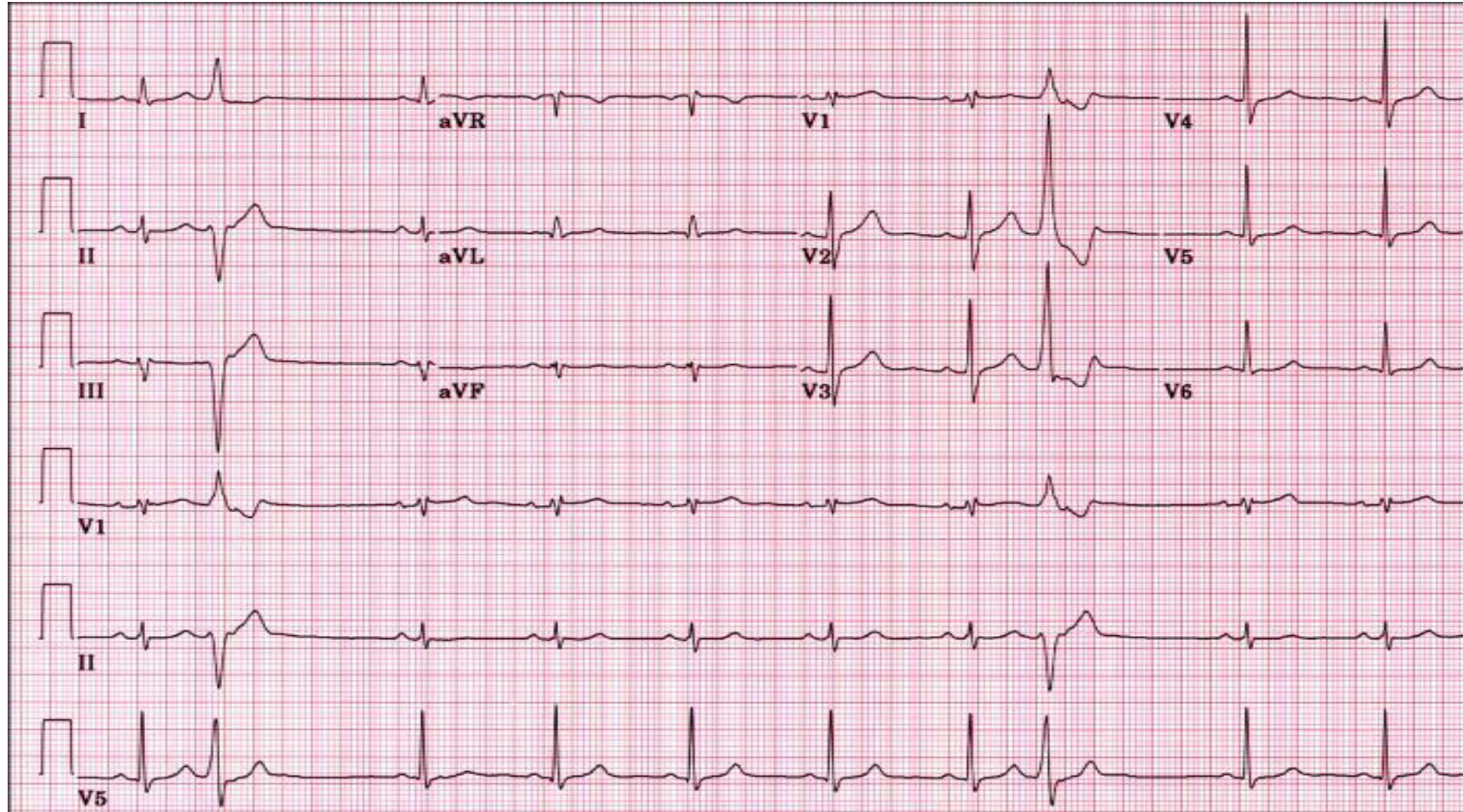
Based upon Richard Meyer's work, the best learning and retention occurs with a teacher narrating with a graph, image, or animation
 Doing this often requires moving your talking points or notes to somewhere else other than the slide

FIX ME



FIX ME

Patient's EKG



Beth Israel Deaconess
Medical Center



HARVARD MEDICAL SCHOOL
TEACHING HOSPITAL

Choose 2

Lorem
ipsum dolor sit
amet, consectetur
adipiscing elit, sed
diam nonummy nibh
euismod tincidunt ut
laoreet dolore magna
aliquam erat
volutpat. Ut



Choose 2

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed diam nonummy nibh euismod tincidunt ut laoreet dolore magna aliquam erat volutpat. Ut



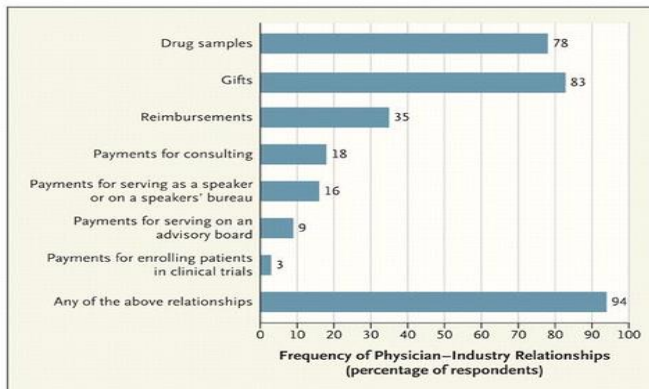
At times, you can't get around having a block of text on your slide.

Avoid the temptation to rephrase it!

It's actually easier for your audience to follow if you just read it directly .

7x7 rule

Choose 2



Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed diam nonummy nibh euismod tincidunt ut laoreet dolore magna aliquam erat volutpat. Ut

Think about
what you can
remove instead
of what
you can add



Cognitive Load Theory

Working Memory

Intrinsic Load

Extraneous Load

Germane Load

Cognitive Load Theory

Intrinsic Load

Inherent Complexity

Task

Expertise

Goal: Manage

Cognitive Load Theory



Extraneous Load

Distraction

Goal: Minimize

Cognitive Load Theory



Germane Load

Learning

Cognitive Load Theory



Germane Load

Learning

Goal: Maximize

Cognitive Load Theory



Intrinsic Load

Extraneous Load

Germane Load

Manage

Minimize

Maximize

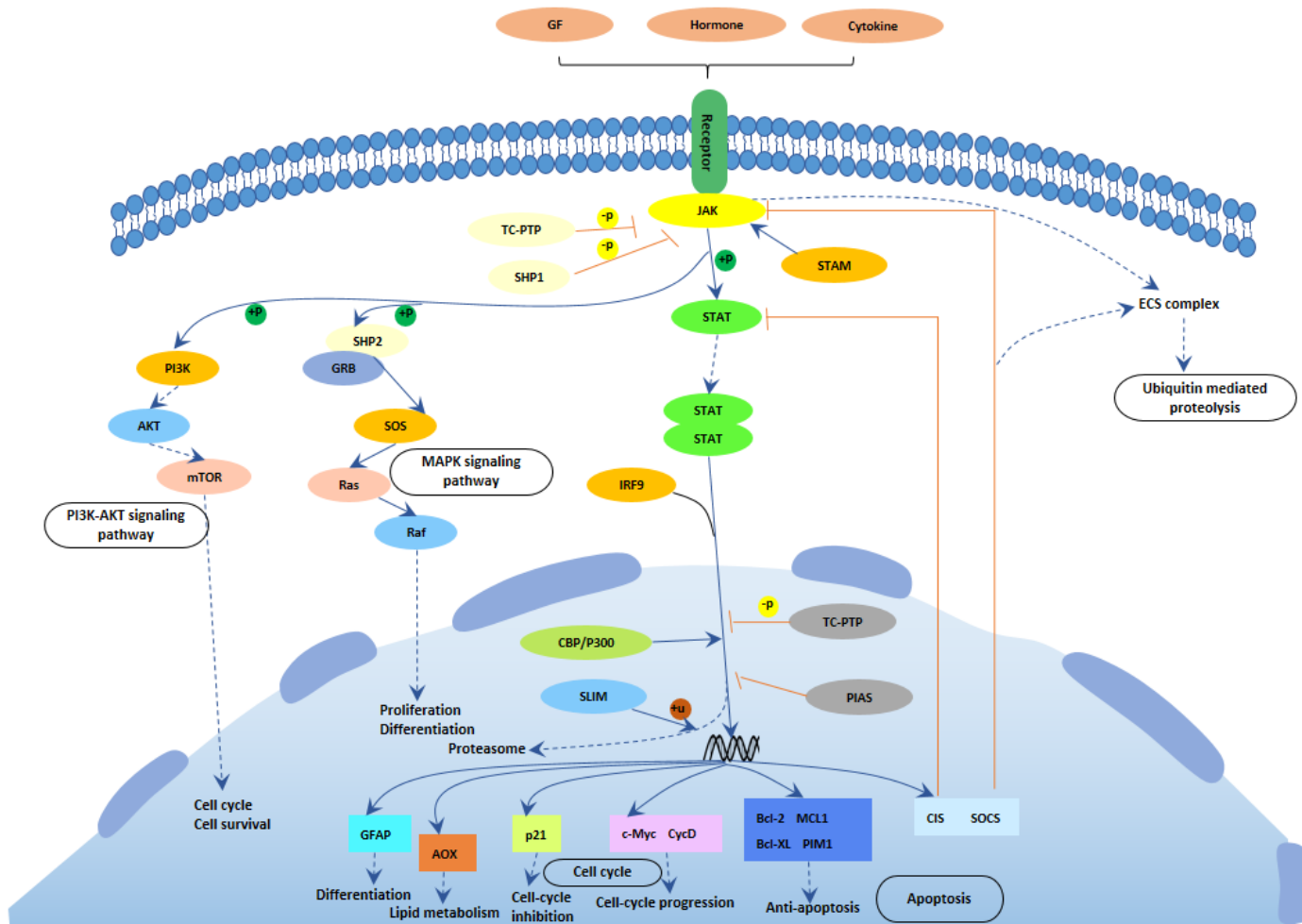
Guide
attention

Eliminate
distractions

Encourage
effort

Cognitive Load Theory

Applied



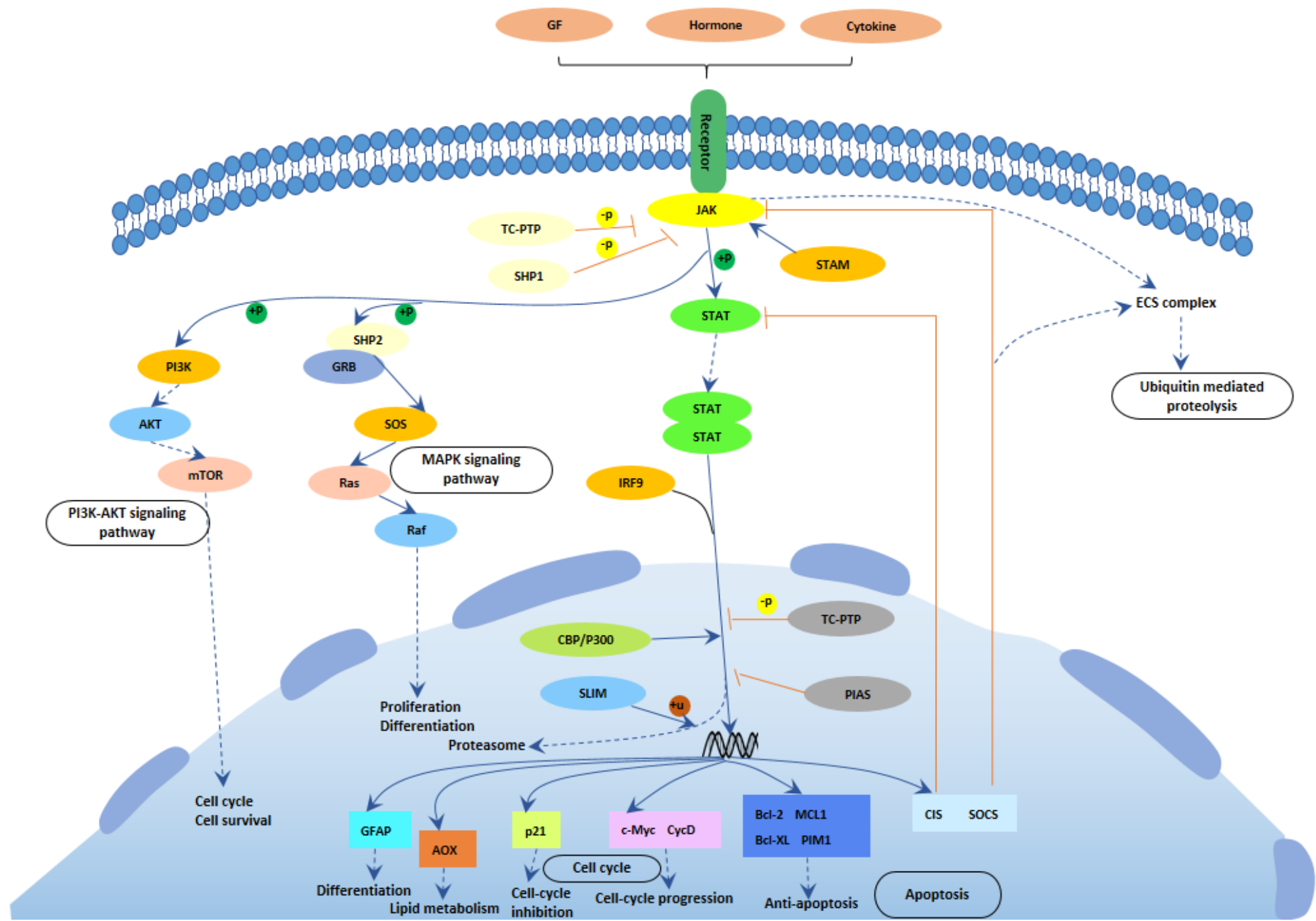
1. Growth factor interacts with receptor
2. JAK phosphorylates STAT as well as PI3K.
3. STAT interacts with the DNA leading to increased transcription of growth factors and anti-apoptotic genes
4. Simultaneously, PI3K signals to AKT and then mTOR to lead to increased cell survival

Type 1 Overload

Essential Processing in visual channel

>

Cognitive Capacity of visual channel

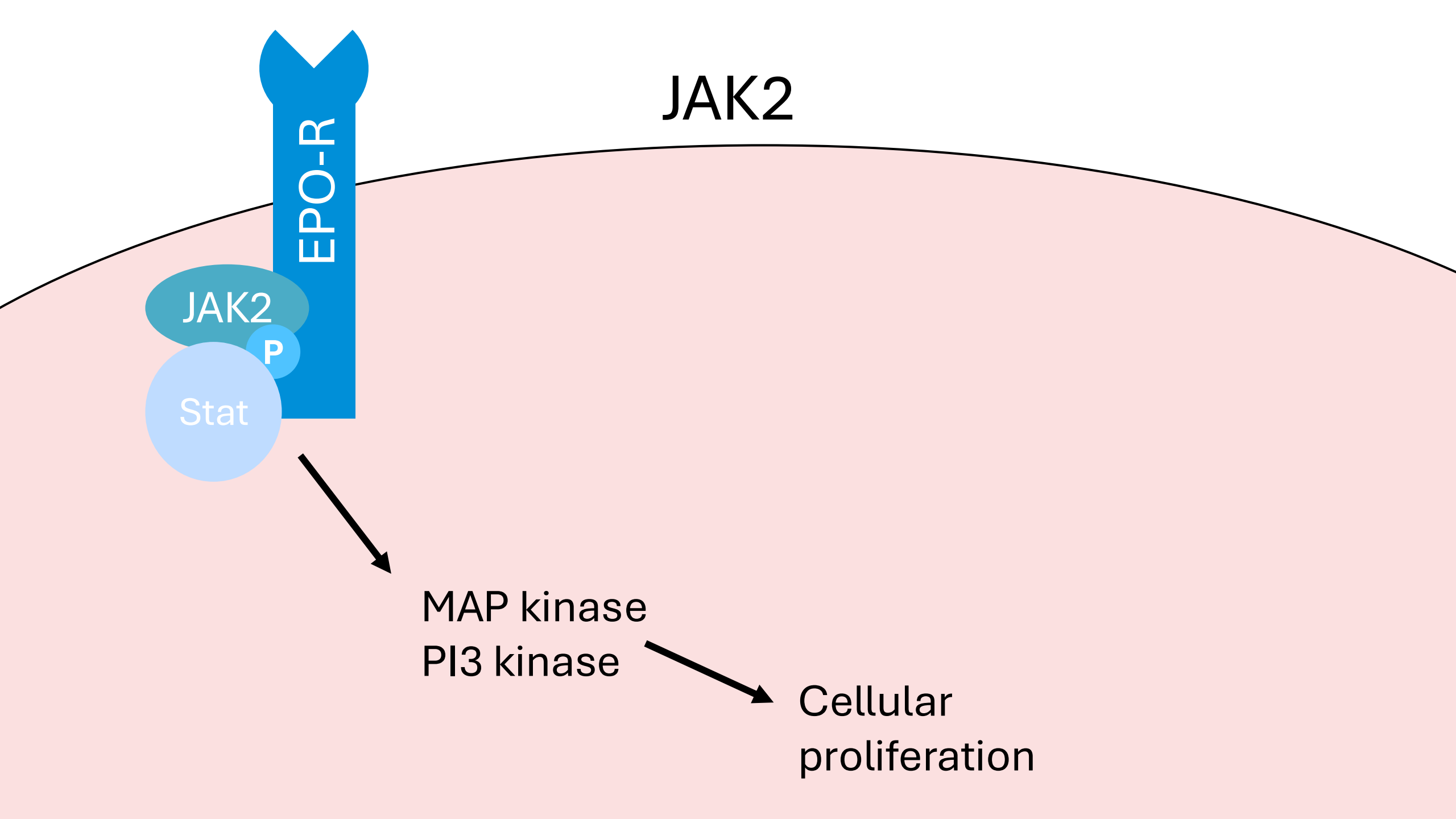


Type 2 Overload

Essential Processing in *both* channels

>

Cognitive Capacity



JAK2

EPO-R

JAK2

P

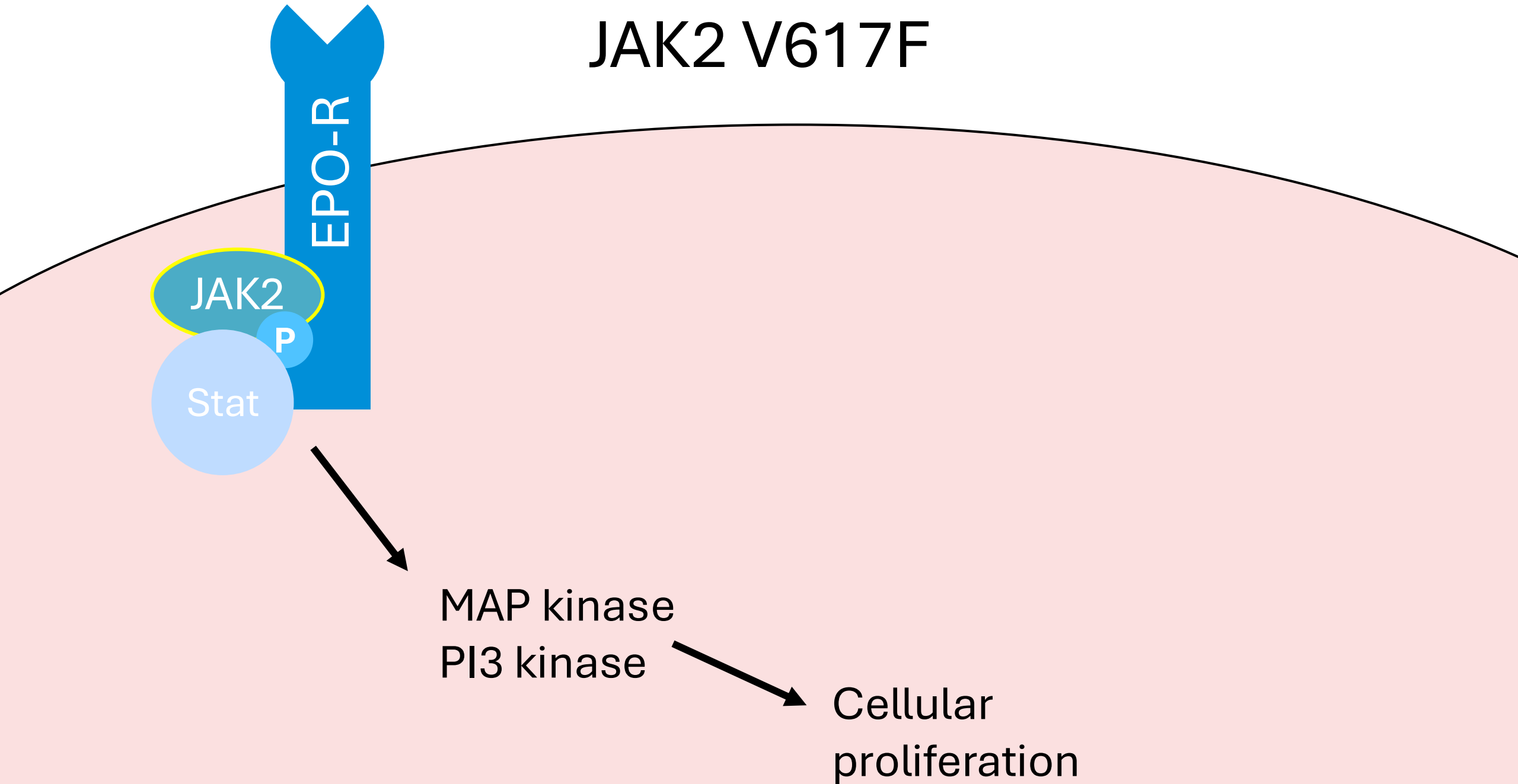
Stat

MAP kinase

PI3 kinase

Cellular
proliferation

JAK2 V617F



JAK2

P

Stat

EPO-R

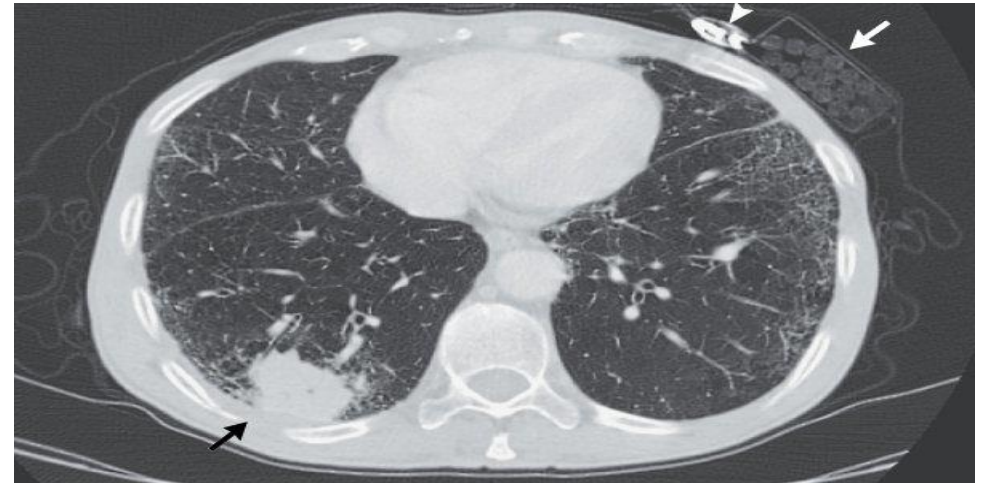
MAP kinase

PI3 kinase

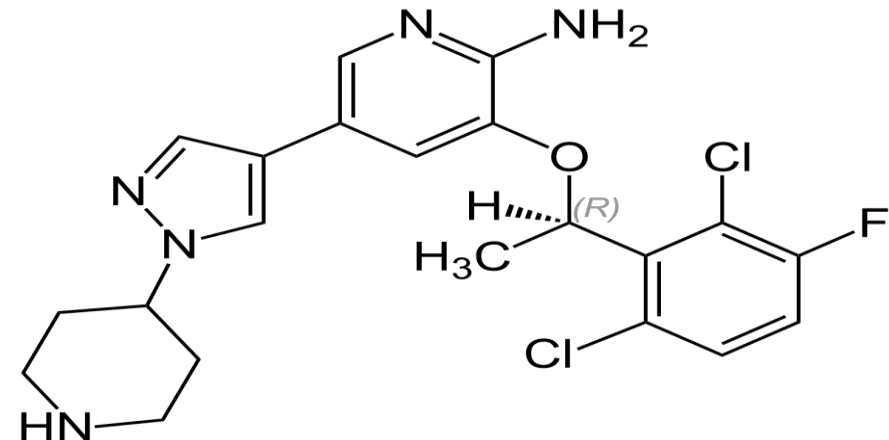
Cellular
proliferation

ALK Mutations in Lung Cancer

- Seen in 2-7% of NSCLC and common in young men (median: 52 years)
- Due to inversion in chromosome 2 that links EML4 to ALK -> cancer cell proliferation
- Does not occur concurrently with EGFR or RAS
- Sensitive to TKI Crizotinib



Pills not shown in actual size.



Type 3 Overload

Essential Processing +
Extraneous Material

>

Cognitive Capacity

ALK Mutations in Lung Cancer

- Seen in 2-7% of NSCLC
- Common in young men (median: 52 years)
- Due to inversion in chromosome 2 that links EML4 to ALK -> cancer cell proliferation
- Does not occur concurrently with EGFR or RAS
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ALK Mutations in Lung Cancer

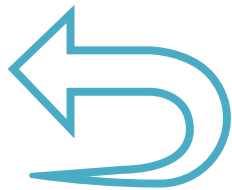


Seen in 2-7% of NSCLC

Common in young men (median: 52 years)



Does not occur concurrently with EGFR or RAS



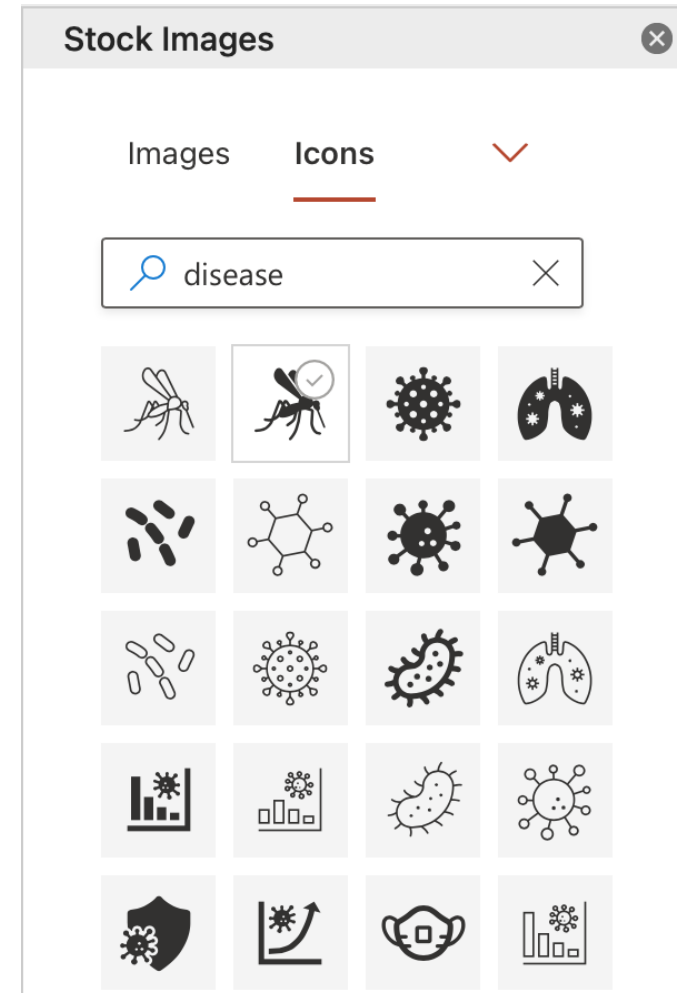
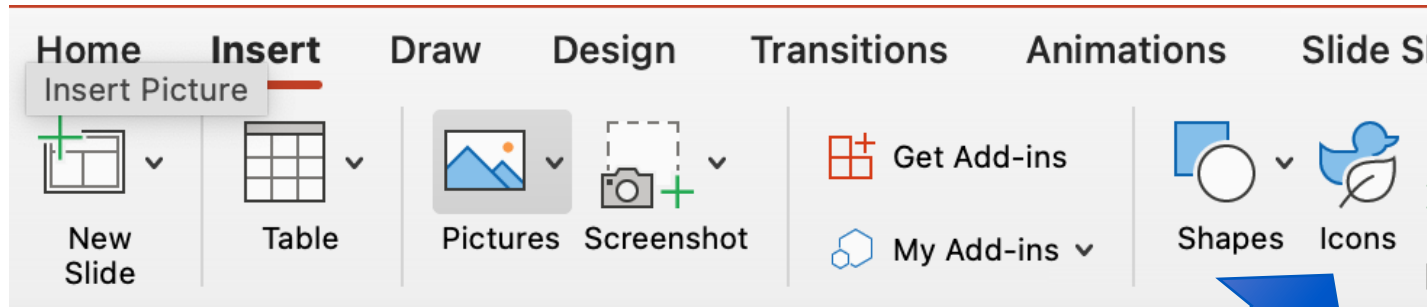
Inversion in chromosome 2
EML4 linked to ALK



Treatment: Oral pill (TKI) Crizotinib



PowerPoint Icons



Noun Project

Noun Project: Free Icons & Stock X

thenounproject.com

Icons and Photos For Everything

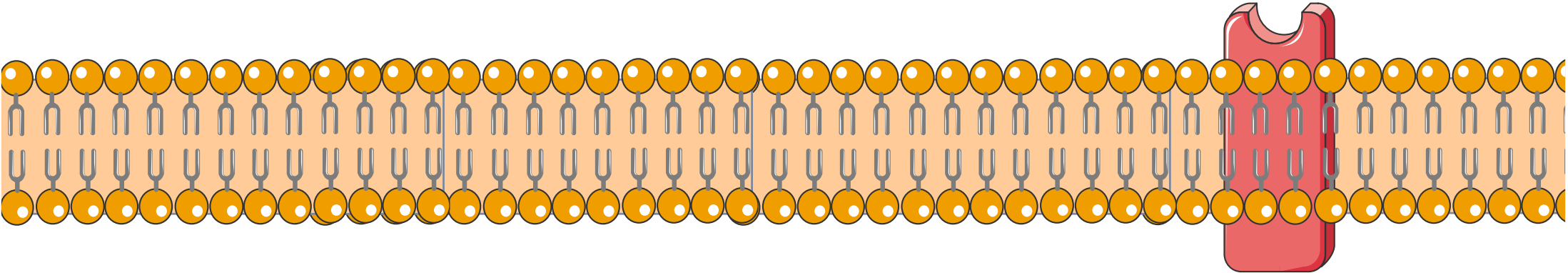
Icons

Search over 3 million icons



bioRENDER

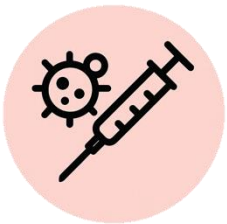
The image shows a browser window displaying the bioRENDER website. The browser's address bar shows the URL `biorender.com`. The website's navigation menu includes links for [Features](#), [Webinars](#), [Icon Library](#), [Pricing](#), [Learning Hub](#), [Testimonials](#), [Sign in](#), and a [Sign up free](#) button. The main content area features the bioRENDER logo and the headline **Create Professional Science Figures in Minutes.** Below this, it states: "Browse thousands of pre-made icons and templates from more than 30 fields of life sciences." A prominent purple button labeled **SIGN UP FREE** is positioned below the text. At the bottom, it notes: "Available online for any computer. No download required." To the right, a preview of the bioRENDER software interface is shown. The interface includes a menu bar (File, Edit, View, Arrange, Share, Object, Help), a search bar for "1000s of icons", and a toolbar with various editing tools. The main workspace displays a grid of icons under the category "Receptors and Ligands". A detailed diagram of a T cell is shown, illustrating the interaction between an Antigen Presenting Cell (APC) and a T cell. The diagram labels the APC, MHC Class II, CD4, CD3, TCR, and IFN- γ production within the T cell.



ChatGPT/Gemini

ChatGPT 5 ▾

Create a set of 5 icons that have a unified theme. Each should have a circle that is a pastel color with a black item inside representing the idea. Size should be 100 x 100 pixels: 1) Medical oncology, 2) radiation oncology, 3) Surgery, 4) Laboratory, 5) Palliative care



Admission Labs

11/05/18 11:30AM BLOOD WBC: 21.7* RBC: 4.40* Hgb: 16.8 Hct: 51.0
MCV: 99* MCH: 32.3* MCHC: 32.6 RDW: 13.3 RDWSD: 48.5* Plt Ct: 280
11/05/18 12:47PM BLOOD UreaN: 22* Creat: 2.5* Na: 140 K: 7.2* [NEW
REFERENCE INTERVAL] Cl: 100 CO2: 21

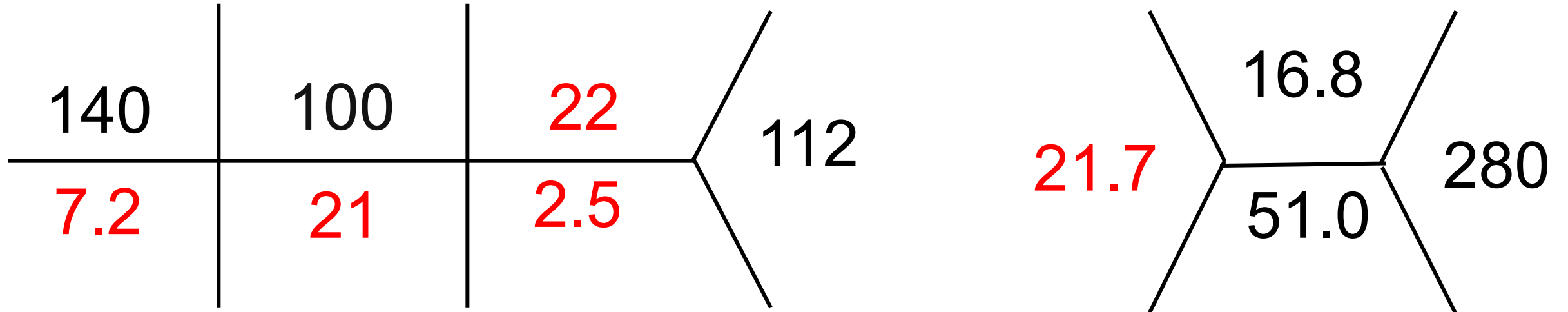
Type 4 Overload

Essential Processing +
Incidental Processing

>

Cognitive Capacity

Admission Labs



Admission Labs

Chemistries

Sodium: 140

Potassium: 7.2

Chloride: 100

Bicarbonate: 21

BUN: 22

Creatinine: 2.5

Glucose: 112

Complete Blood Count

WBC: 21.7

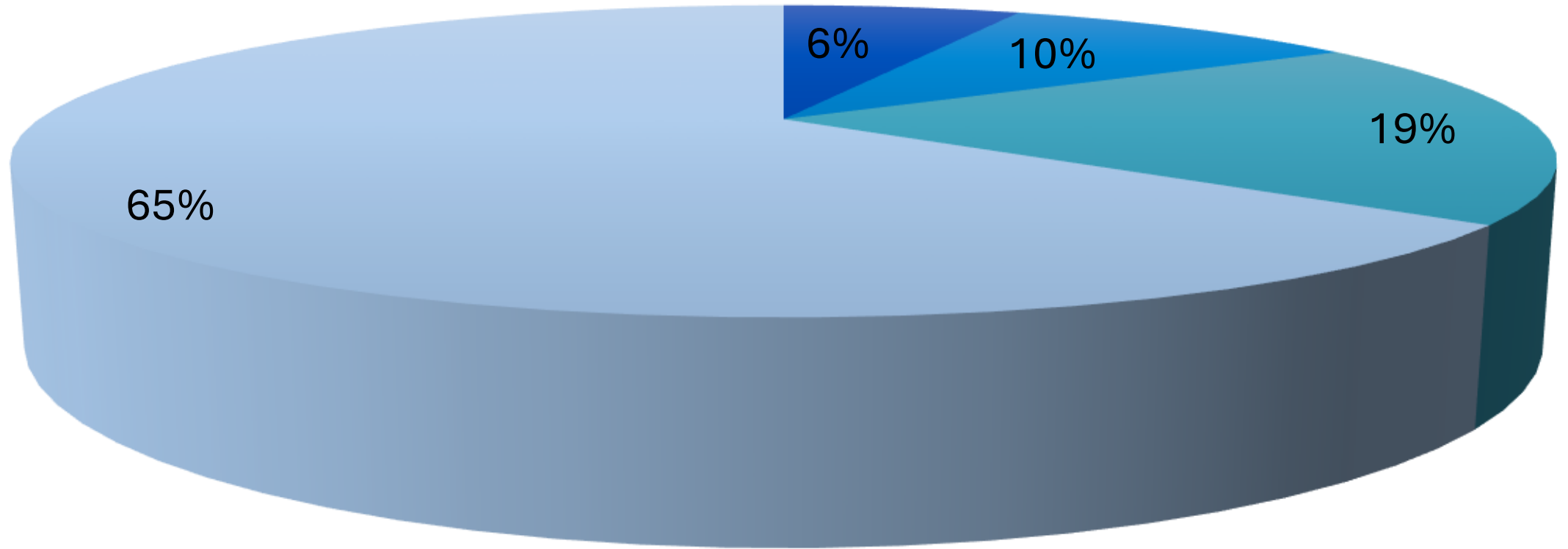
Hemoglobin: 16.8

Hematocrit: 51.0

Platelets: 280

Percentage of time a chart is confusing

■ Line ■ Bar ■ 3D Bar ■ Pie



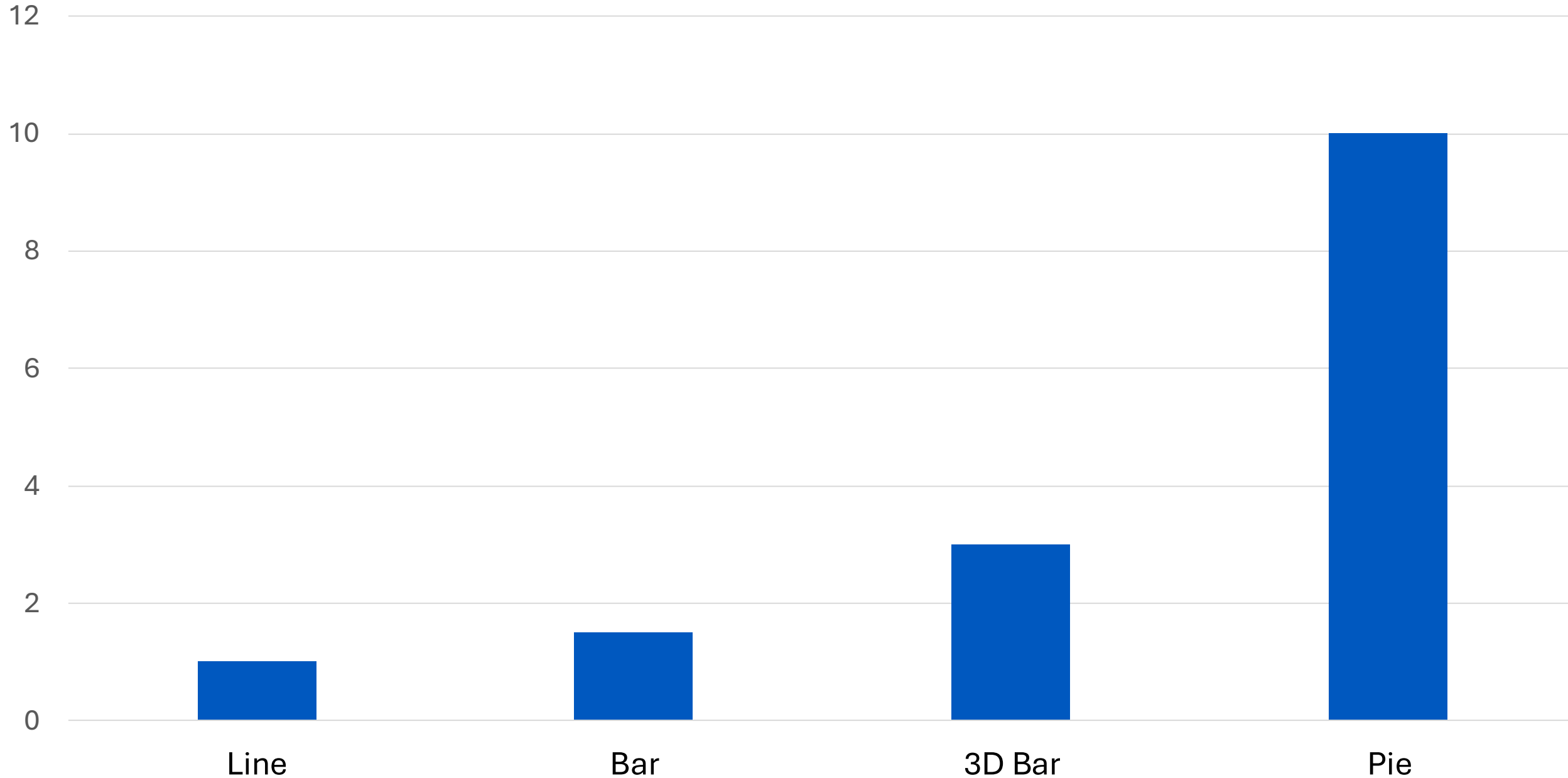
Type 4 Overload

Essential Processing +
Incidental Processing

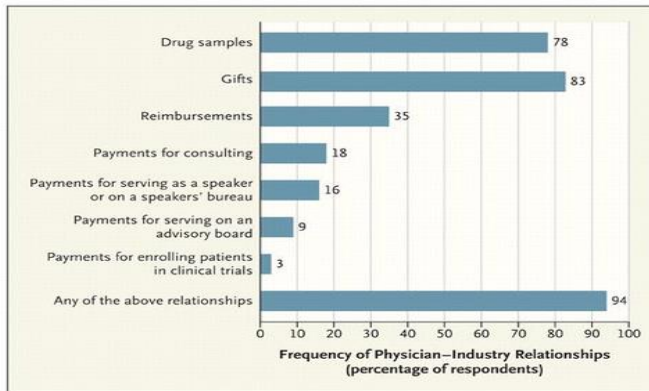
>

Cognitive Capacity

How Hard Information is to Process, by Type



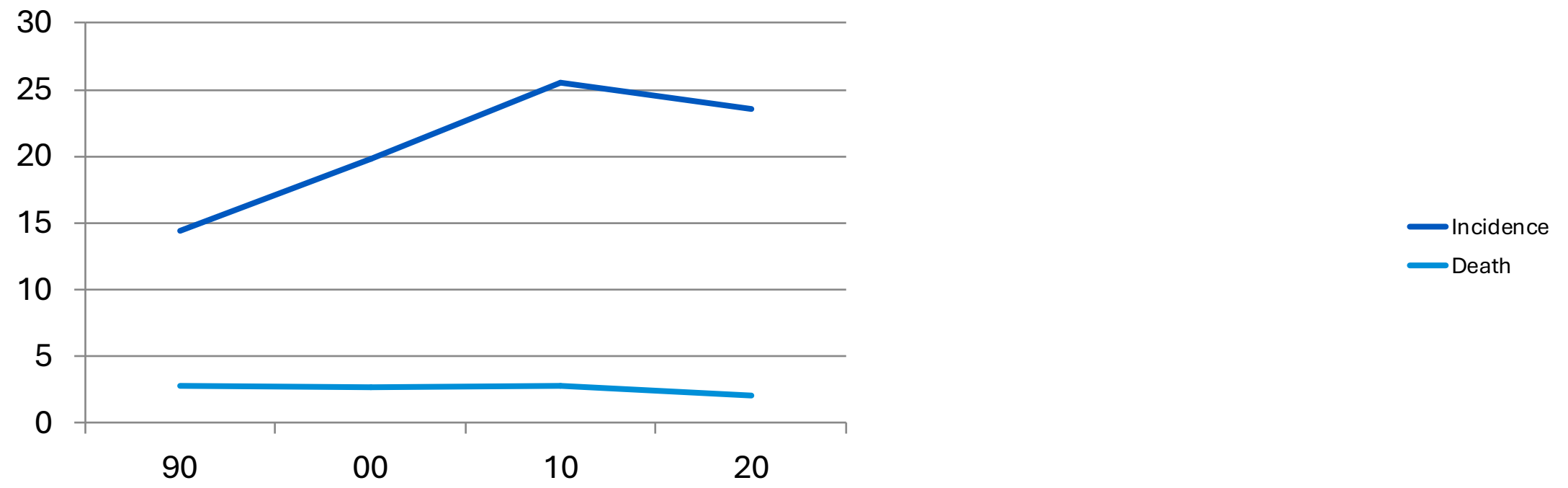
Choose 2

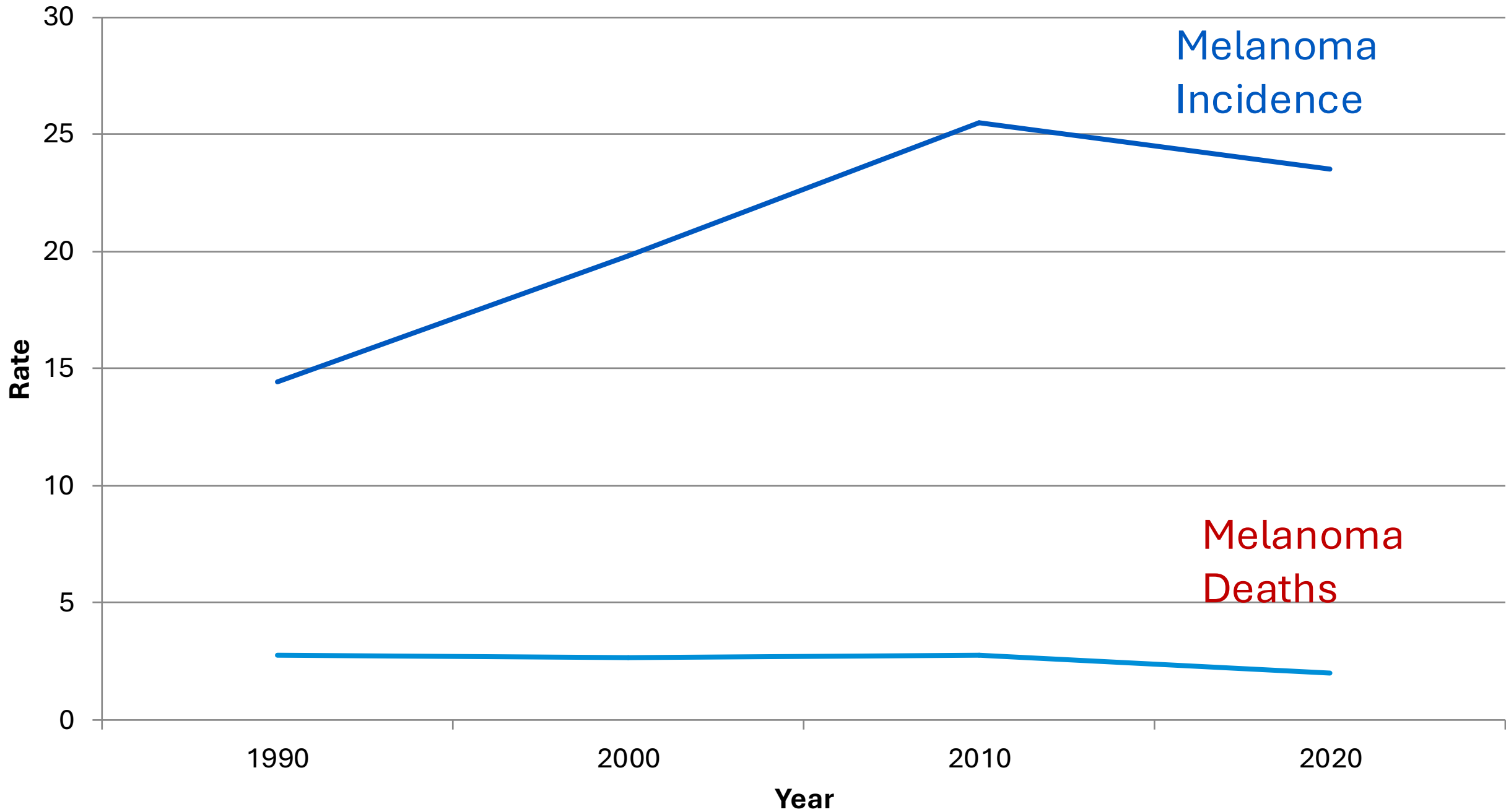


FIX ME



New diagnoses of Melanoma are *substantially higher* in the past 30 years, but death rates continue to drop





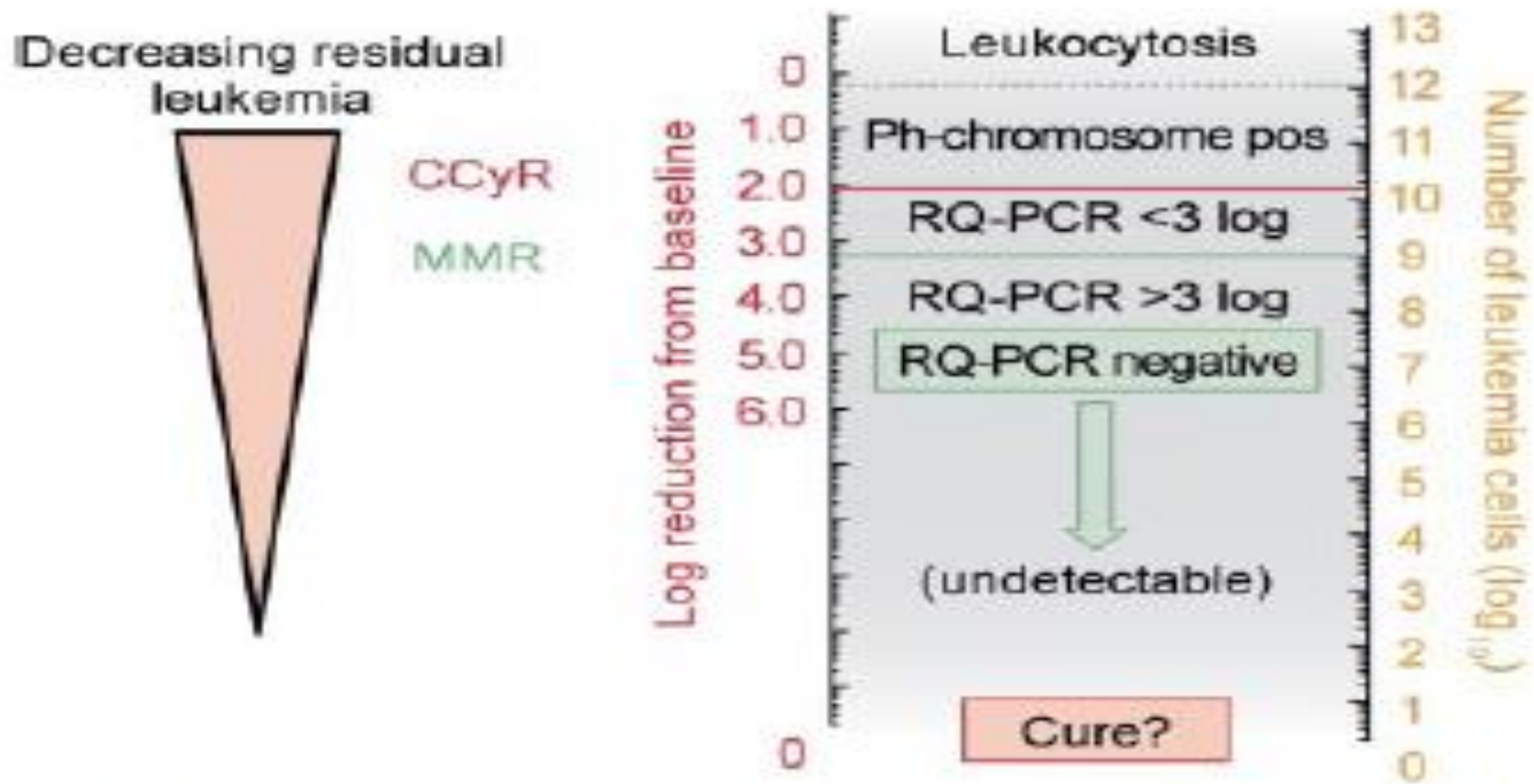


Figure 3. Schematic representation of decreasing residual disease related to numbers of BCR-ABL transcripts in the peripheral blood (left scale) and estimated number of residual leukemia cells in a patient's body (right scale).

Type 5 Overload:

Essential Processing
+ Representational Holding

>

Cognitive Capacity

“ When using a new acronym or term that you aren't 100% sure your learners know, **define it at least 3 times** before using it alone ”



Jason Freed

Table 1. Demographic and Clinical Characteristics of the Patients at Baseline.*

Characteristic	Apixaban (N = 1345)	Rivaroxaban (N = 1355)
Age — yr	58.0±16.3	58.5±15.8
Female sex — no. (%)	597 (44.4)	578 (42.7)
Race or ethnic group — no. (%)†		
White	1182 (87.9)	1218 (89.9)
Black	51 (3.8)	44 (3.2)
Asian	36 (2.7)	31 (2.3)
Hispanic or Latino	21 (1.6)	13 (1.0)
Indigenous or Aboriginal	8 (0.6)	4 (0.3)
Other	38 (2.8)	35 (2.6)
Country — no. (%)		
Canada	1244 (92.5)	1254 (92.5)
Australia	100 (7.4)	98 (7.2)
Ireland	1 (0.1)	3 (0.2)
Body weight — kg	85.9±16.4	85.2±15.8
Body-mass index‡	29.1±5.2	28.9±5.1
Creatinine clearance		
Overall — ml/min	107.1±38.8	105.6±38.3
<50 ml/min — no. (%)	60 (4.5)	63 (4.6)
Continued antiplatelet use — no. (%)	36 (2.7)	35 (2.6)
Qualifying venous thromboembolism diagnosis — no. (%)§		
Deep-vein thrombosis alone	691 (51.4)	718 (53.0)
Pulmonary embolism with or without deep-vein thrombosis	654 (48.6)	637 (47.0)
Provoked venous thromboembolism¶	322 (23.9)	290 (21.4)
Unprovoked venous thromboembolism	1022 (76.0)	1065 (78.6)
History of venous thromboembolism — no. (%)	210 (15.6)	219 (16.2)

Table 1. Demographic and Clinical Characteristics of the Patients at Baseline.*

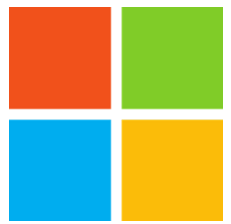
Characteristic	Apixaban (N = 1345)	Rivaroxaban (N = 1355)
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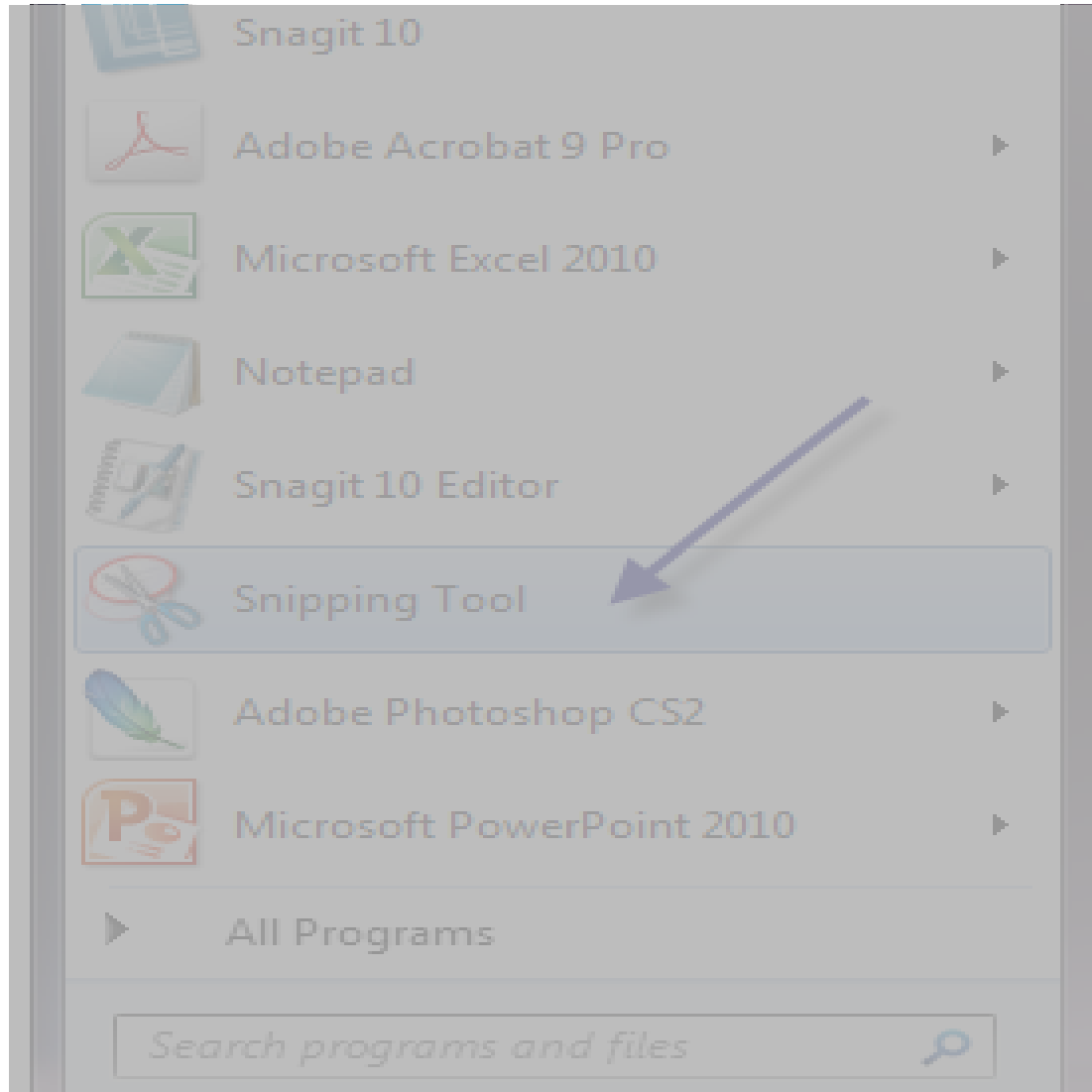
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Snipping on Windows



PrtScn

- Copies entire screen to clipboard

Win+Shift+S

- Opens snipping tool

Win+Alt+R

- Video capture tool





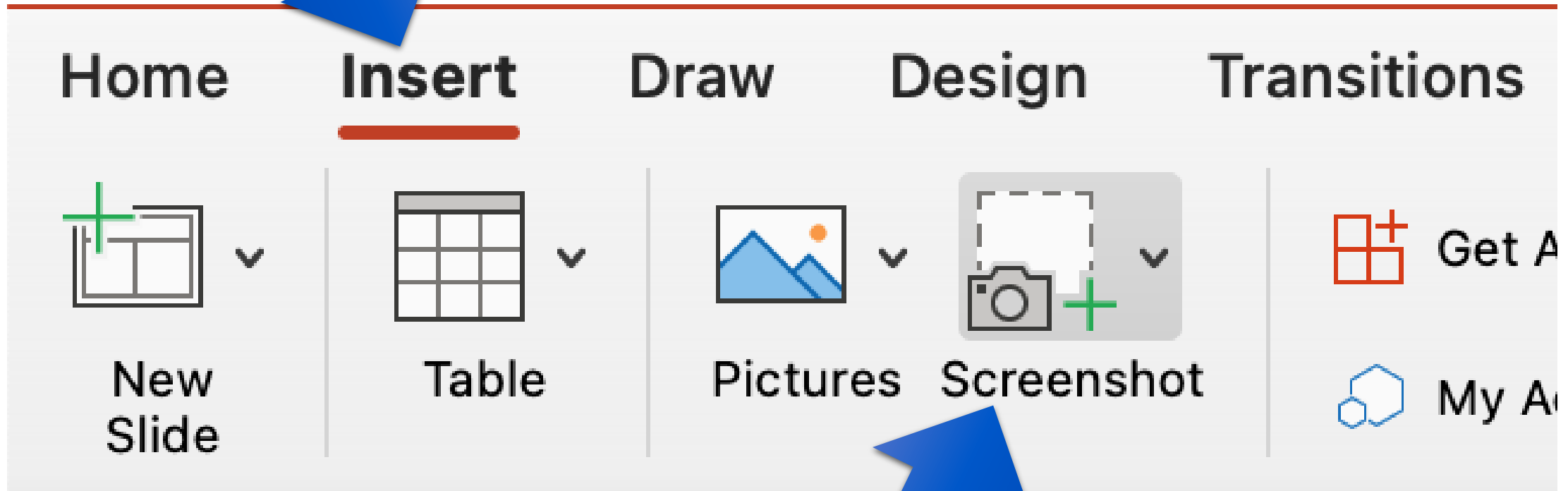
Snipping on a Mac

- **Shift+Cmd+3:** Save image of entire screen to desktop
- **Shift+Cmd+4:** Snip a specific area of the screen to the desktop
- **Shift+Cmd+5:** Video capture tool (select the part of the screen, start it and then stop via “stop” button in upper menu bar)





Snip Tool Built-in to PowerPoint



REMEMBER, WITH



Snipping Tool



COMES GREAT RESPONSIBILITY

CLINICAL PRESENTATION

Chronic phase CML

Treatment considerations independent of risk score

- Comorbidities
- Toxicity profile of TKI
- Possible drug interactions
- Patient preference

Low-risk score
([See Risk Calculation Table CML-A](#))

Intermediate- or high-risk score
([See Risk Calculation Table CML-A](#))

PRIMARY TREATMENT

Preferred regimens
First-generation TKI ([Imatinib](#) or generic imatinib 400 mg QD [category 1])
or
Second-generation TKI (alphabetical order)
([Bosutinib](#) 400 mg QD [category 1])
or
[Dasatinib](#) 100 mg QD [category 1]
or
[Nilotinib](#) 300 mg BID [category 1])
or
Clinical trial

[See Evidence Blocks on CML-2A](#)

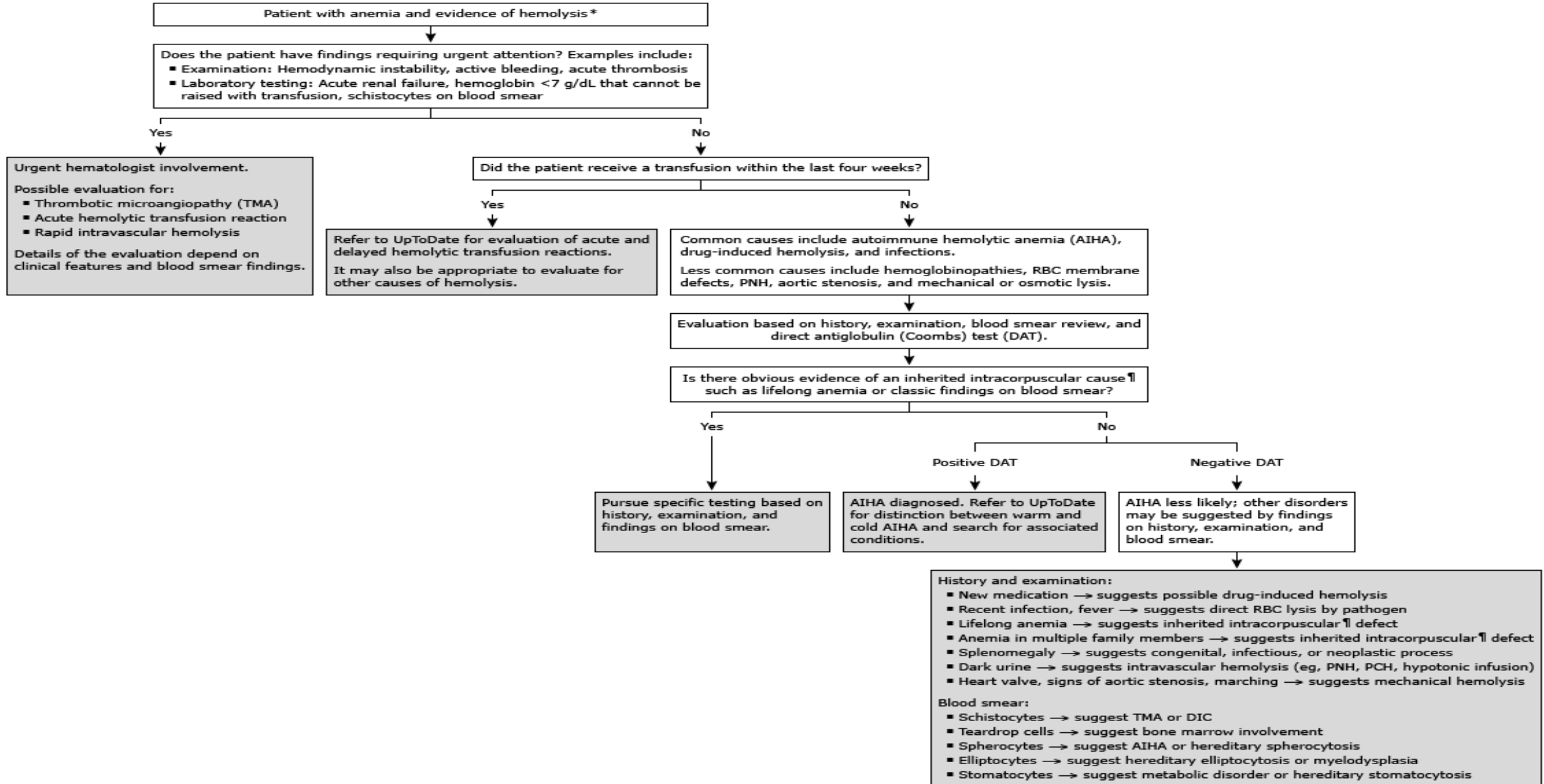
Preferred regimens
Second-generation TKI (alphabetical order)
([Bosutinib](#) 400 mg QD [category 1]^e)
or
[Dasatinib](#) 100 mg QD [category 1]^e
or
[Nilotinib](#) 300 mg BID [category 1]^e)
or
Other recommended regimens
First-generation TKI ([Imatinib](#) or generic imatinib 400 mg QD)^f
or
Clinical trial

[See Response Milestones and Treatment Options \(CML-3\)^d](#)

[See Response Milestones and Treatment Options \(CML-3\)^d](#)

Never say “I know you can’t read this but...”

Evaluation of unexplained hemolytic anemia



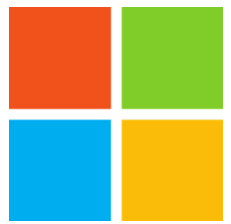
Causes of an elevated serum lactate dehydrogenase level

Cardiac	<p>Myocyte injury</p> <ul style="list-style-type: none"> • Demand ischemia • Trauma, cardiovascular surgery • Toxins • Infection (myocarditis, rheumatic fever) • Drugs (alcohol, chemotherapy, cocaine, methysergide, carbon monoxide) <p>Hepatic congestion</p> <ul style="list-style-type: none"> • Heart failure <p>Hemolysis</p> <ul style="list-style-type: none"> • Prosthetic valves
Central nervous system disorders	<ul style="list-style-type: none"> • Bacterial meningitis • Cerebral hemorrhage • Cerebral venous thrombosis
Drug-Induced	<ul style="list-style-type: none"> • Neuroleptic agents (neuroleptic malignant syndrome) • Withdrawal of L-Dopa or dopamine agonist • Serotonin syndrome • Malignant hyperthermia • Recreational drugs • Myopathies (colchicine, antimalarials, cholesterol-lowering drugs, cocaine, alcohol, glucocorticoid)
Endocrine	<ul style="list-style-type: none"> • Hypothyroidism • Acromegaly • Cushing's syndrome • Diabetic muscle infarction
Gastrointestinal	<ul style="list-style-type: none"> • Acute pancreatitis • Intestinal obstruction • Early acute hepatitis • Ischemic hepatitis
Hematologic	<p>Hemolytic anemias</p> <ul style="list-style-type: none"> • Inherited (spherocytosis, sickle cell disease, deficiency of red blood cell enzymes) • Acquired (microangiopathic hemolytic anemia, PNH, immune hemolysis) <p>Ineffective erythropoiesis</p> <ul style="list-style-type: none"> • Pernicious anemia, folic acid deficiency • Iron deficiency • Primary myelofibrosis
Infection	<ul style="list-style-type: none"> • Pneumocystis pneumonia (late) • Tuberculosis • Malaria • Parasitic • Legionnaires disease • Histoplasmosis • Toxoplasmosis
Malignancy	<ul style="list-style-type: none"> • Leukemias • Lymphomas • Solid tumors (testicular germ cell tumors) • Tumor lysis syndrome (large tumor burden)
Neuromuscular	<ul style="list-style-type: none"> • Myopathies (inherited, acquired, drug) • Periodic paralyses
Pregnancy	<ul style="list-style-type: none"> • Preeclampsia • Adnexal mass in pregnancy • HELLP syndrome
Pulmonary	<ul style="list-style-type: none"> • Pulmonary embolism, infarction • Pulmonary alveolar proteinosis
Renal	<ul style="list-style-type: none"> • Renal infarction
Rheumatologic	<ul style="list-style-type: none"> • Dermatomyositis • MCTD • Rheumatoid arthritis • Scleroderma • Sjögren's syndrome • SLE
Trauma	<ul style="list-style-type: none"> • Rhabdomyolysis • Surgery
Vasculitis	<ul style="list-style-type: none"> • Polyarteritis nodosa

“Lecturing is that mysterious process by which the lecture notes of the professor are transferred to the students’ lecture notes, without passing through the brains of either.”



– Often attributed [incorrectly] to Mark Twain



Helpful Slideshow Shortcuts

- **F5**: Start the presentation from the beginning
- **Shift+F5**: Start the presentation from the current slide
- **Ctrl+P**: Annotate with the Pen tool during a slideshow
- **E**: Erase all annotations
- **B**: Change the screen to black during a slideshow
- **W**: Change the screen to white during a slideshow
- **Esc**: End the slideshow
- **“Number” and then enter**: go to slide “number”





Helpful Slideshow Shortcuts

- **Shift+Cmd+Enter:** Play from the beginning
- **Cmd+Enter:** Play from the current slide
- **Cmd+P:** Annotate with the Pen tool during a slideshow
- **E:** Erase all annotations
- **B:** Change the screen to black during a slideshow
- **W:** Change the screen to white during a slideshow
- **Esc:** End the slideshow
- **“Number” and then enter:** go to slide “number”



Cognitive Load Theory



Intrinsic Load

Extraneous Load

Germane Load

Manage

Minimize

Maximize

Guide
attention

Eliminate
distractions

Encourage
effort

**Knowing nothing else about the speaker or topic,
would you rather attend a medical lecture that is
a PowerPoint or a “Chalk Talk”?**



PowerPoint



Chalk Talk



Intrinsic Load

Extraneous Load

Germane Load



Intrinsic Load

Extraneous Load

Germane Load



Intrinsic
Load

Extraneous
Load

Germane Load

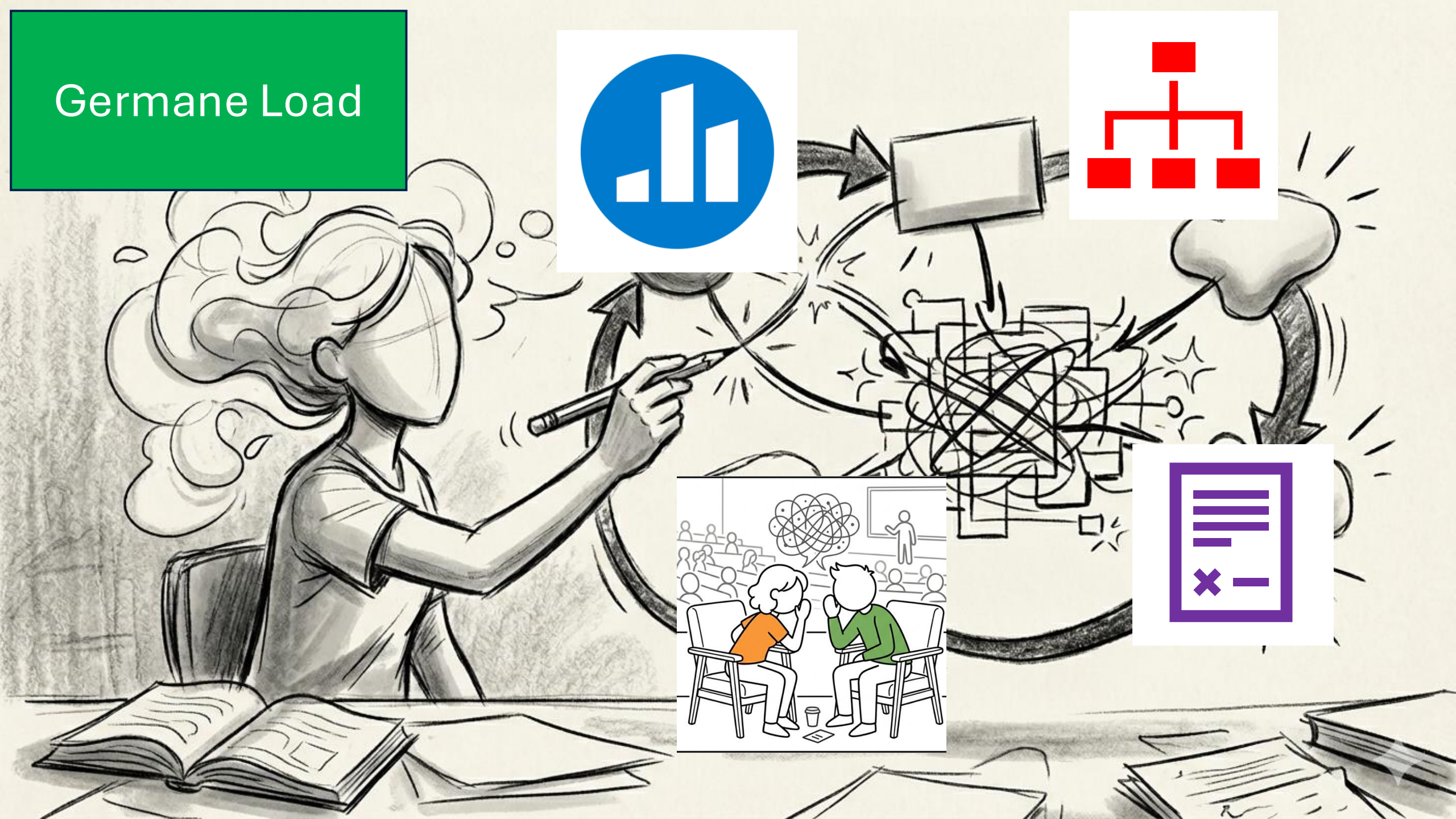
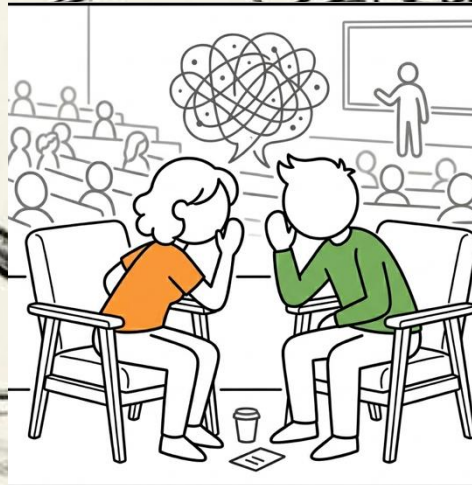
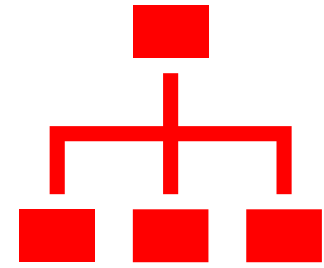


Intrinsic
Load

Extraneous
Load

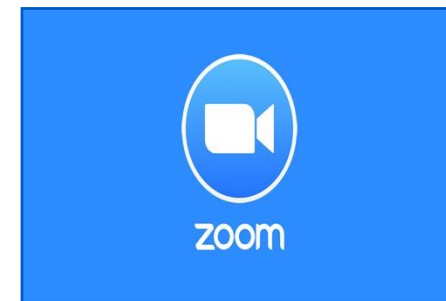
Germane
Load

Germane Load



Use polling software wisely

and make sure you know what to use for each
situation



Embed?



Requires permissions



Requires permissions



Question Types?

Wide variety

Multiple choice

Wide variety

Some variety

of People?

40 (free)

500

100 (free)

No limit

Cost?

Freemium

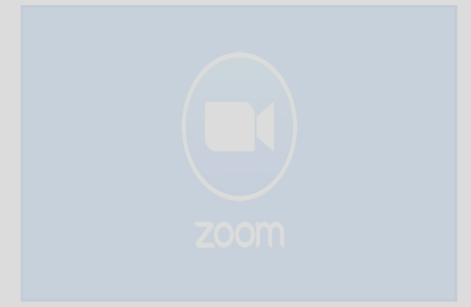
Free

Freemium (3 Qs for free)

Institutionally Licensed



In person?



Don't forget about "analog" polling!

Requires permissions

Requires permissions

Question Types?



Wide variety

Multiple choice

1

Wide variety

2

Some variety

of People?

500

3

100 (free)

4

No limit

Cost?

Freemium

Free

Freemium (3 Qs for free)

Institutionally Licensed

When to embed a poll?

- You are presenting from your own computer
- ...using desktop PowerPoint software
- ...and you've tested it and are confident it works

Use Polling Without Embedding

- Pull up the dashboard/cockpit first
- Know how audience will vote (and ideally give multiple options)

- Enter a URL
- Text/SMS
- QR codes



- If on zoom, share full screen (not just the window)



Intrinsic Load

Extraneous Load

Germane Load



Intrinsic Load

Extraneous Load

Germane Load



Intrinsic Load

Extraneous Load

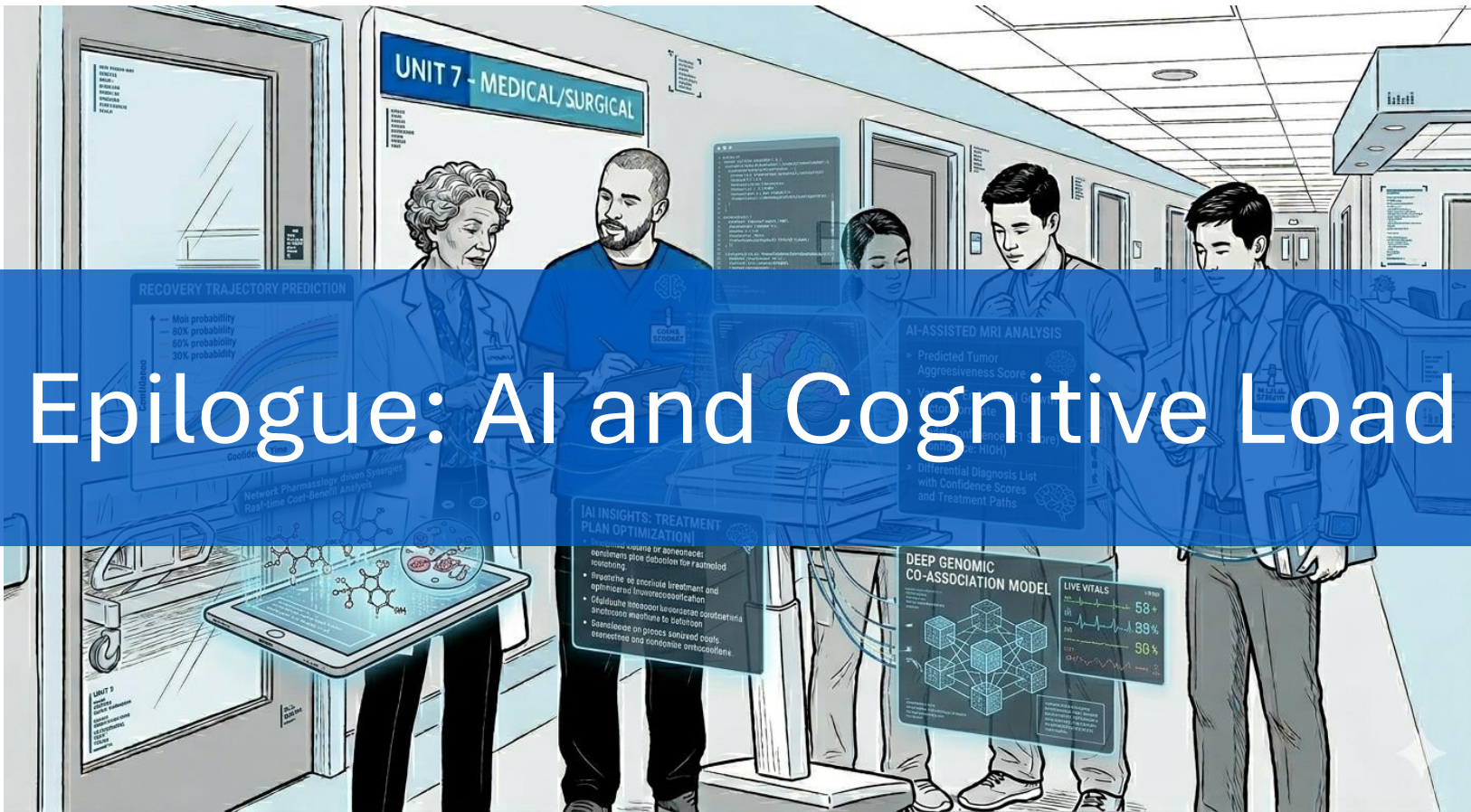
Germane Load



Intrinsic Load

Extraneous Load

Germane Load



Epilogue: AI and Cognitive Load

Intrinsic Load

Extraneous Load

Germane Load



Intrinsic Load

Extraneous Load

Germane Load



Intrinsic
Load

Extraneous
Load

Germane
Load




Intrinsic
Load

Extraneous
Load

Germane
Load

Beware of metacognitive laziness: Effects of generative artificial intelligence on learning motivation, processes, and performance

Yizhou Fan^{1,2}  | Luzhen Tang¹ | Huixiao Le¹ | Kejie Shen¹ |
Shufang Tan¹ | Yueying Zhao¹ | Yuan Shen³ | Xinyu Li² |
Dragan Gašević²

Computers in Human Behavior 175 (2026) 108779



Contents lists available at [ScienceDirect](https://www.sciencedirect.com)









Computers in Human Behavior

journal homepage: www.elsevier.com/locate/comphumbeh



Full length article

AI makes you smarter but none the wiser: The disconnect between performance and metacognition

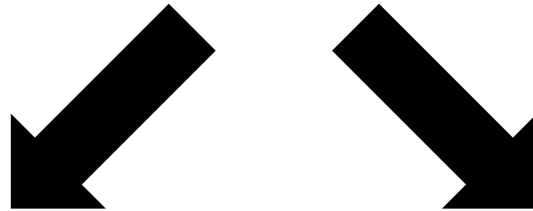
Daniela Fernandes^a , Steeven Villa^b , Salla Nicholls^a, Otso Haavisto^a , Daniel Buschek^c ,
Albrecht Schmidt^b , Thomas Kosch^d , Chenxinran Shen^e , Robin Welsch^a 



Review

Cognitive Offloading

Evan F. Risko^{1,*} and Sam J. Gilbert^{2,*}



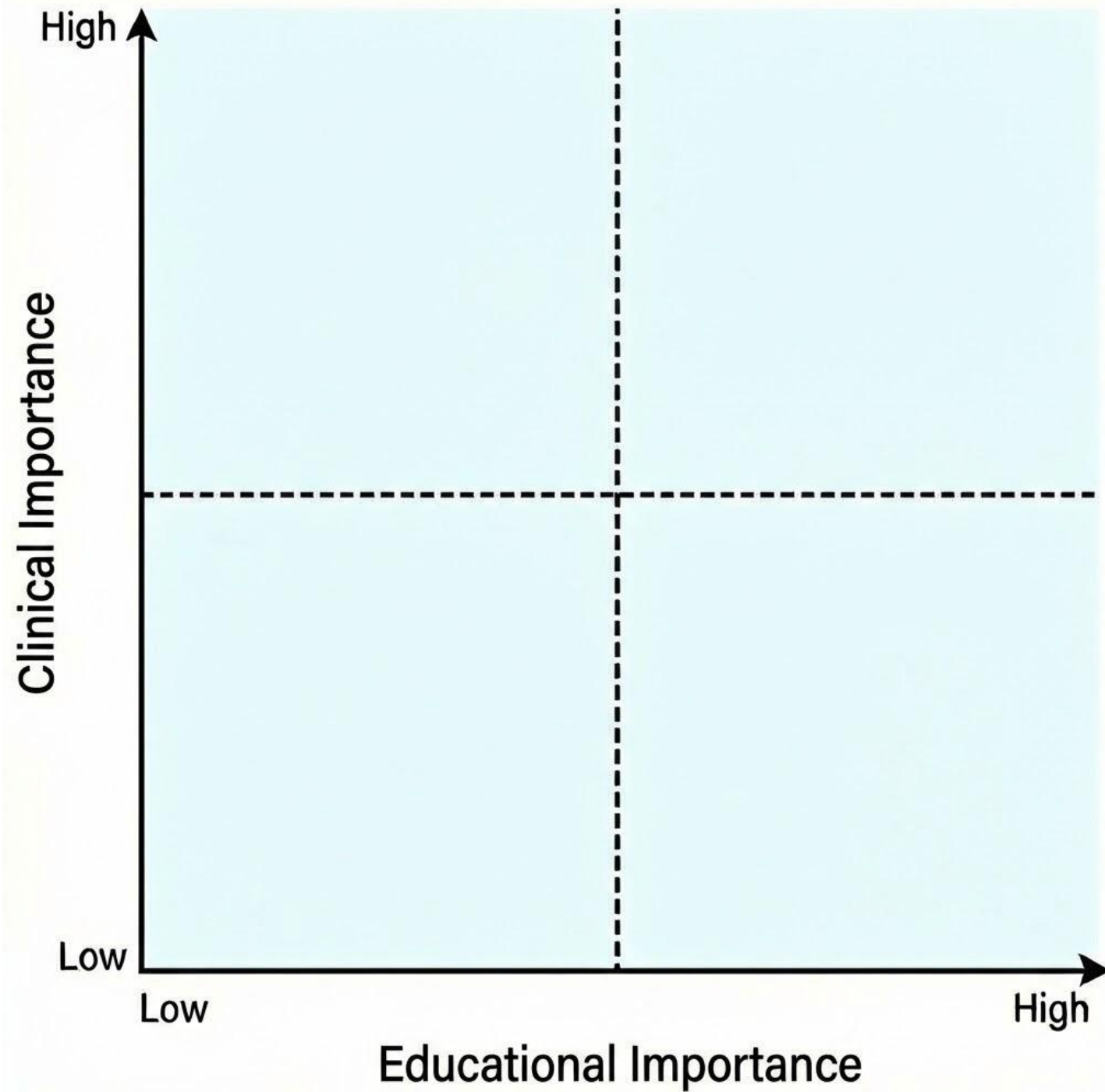
Onto-the-Body

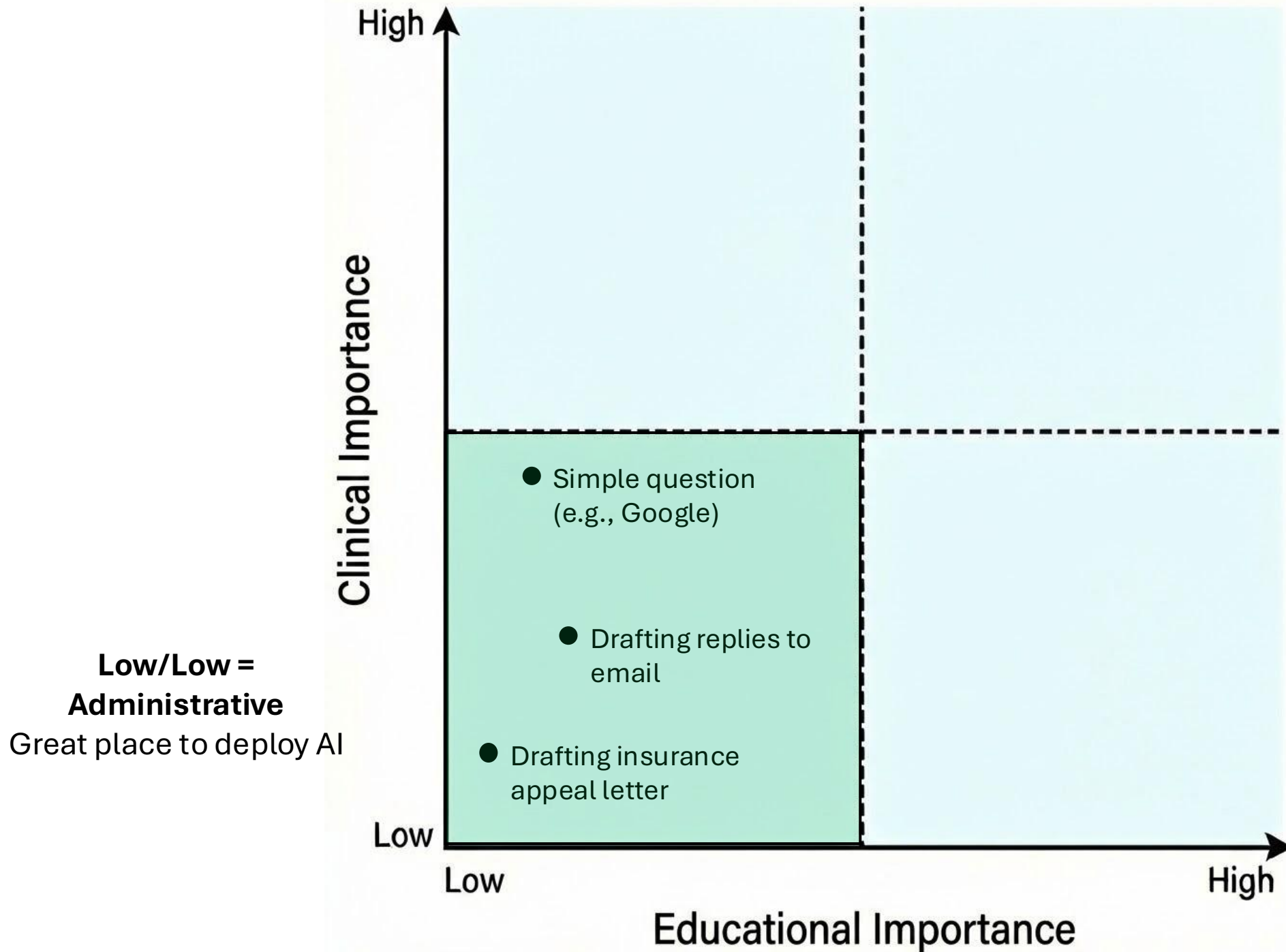
Into-the-World



Germane Load

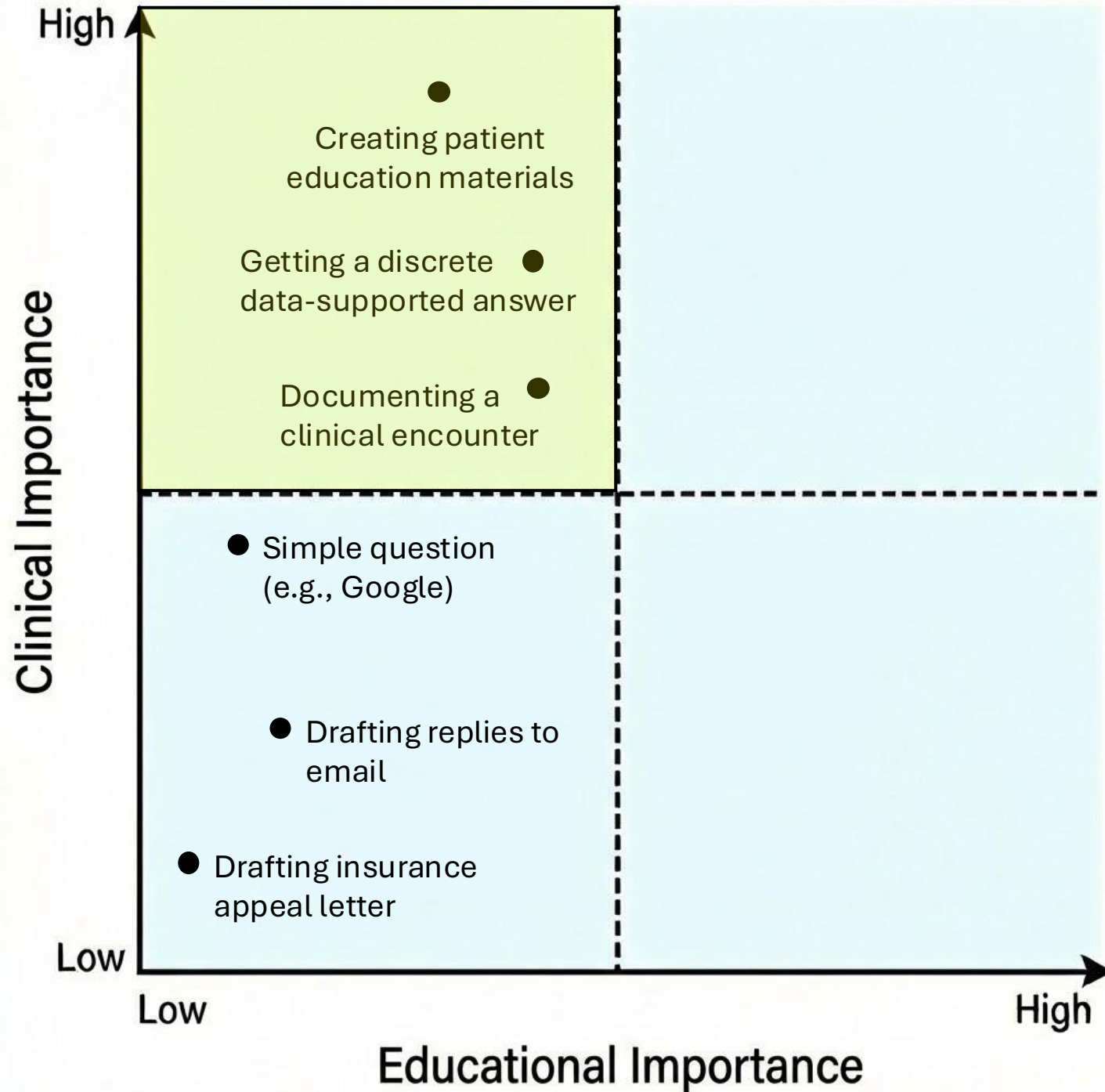
Extraneous Load

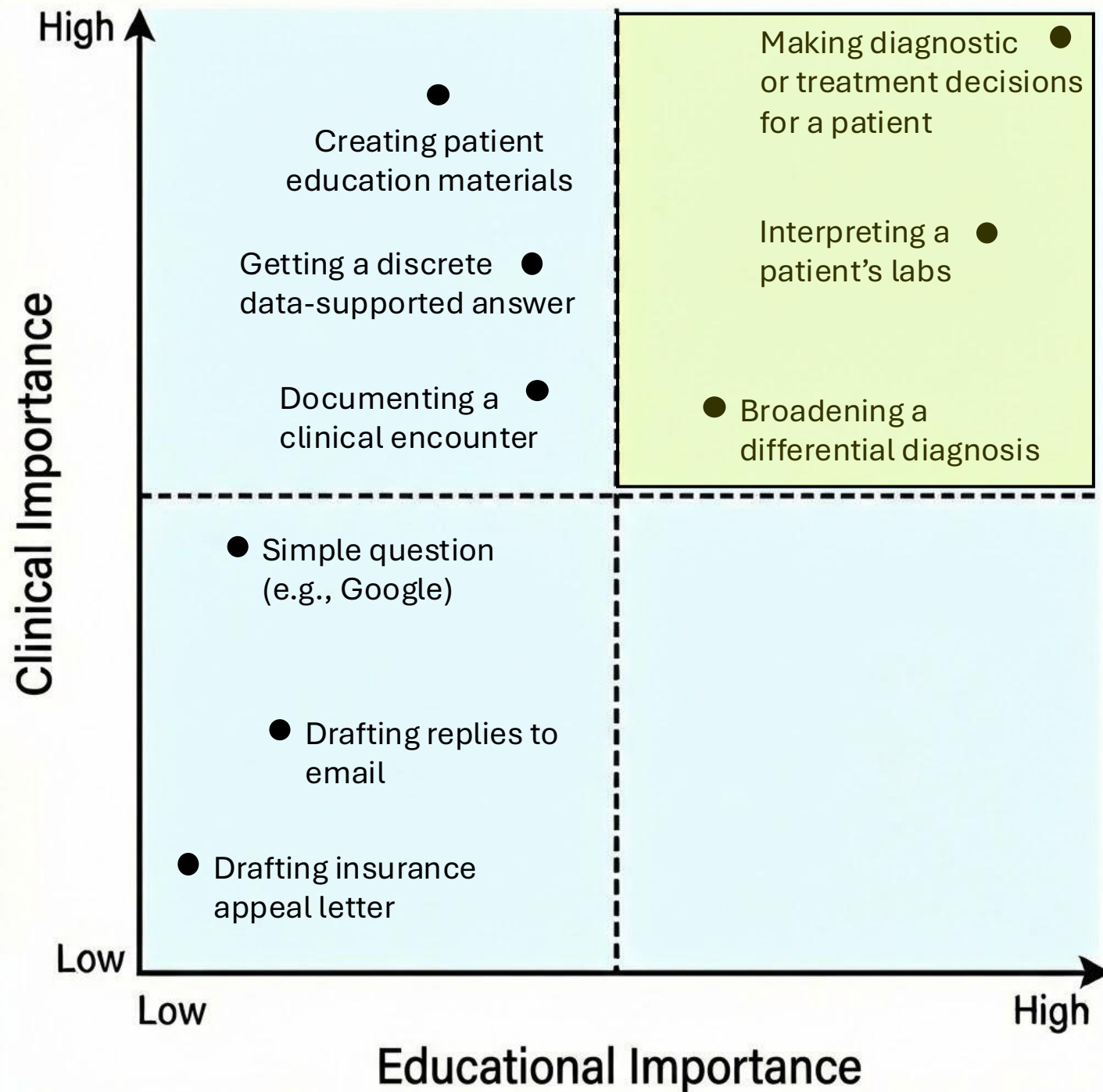




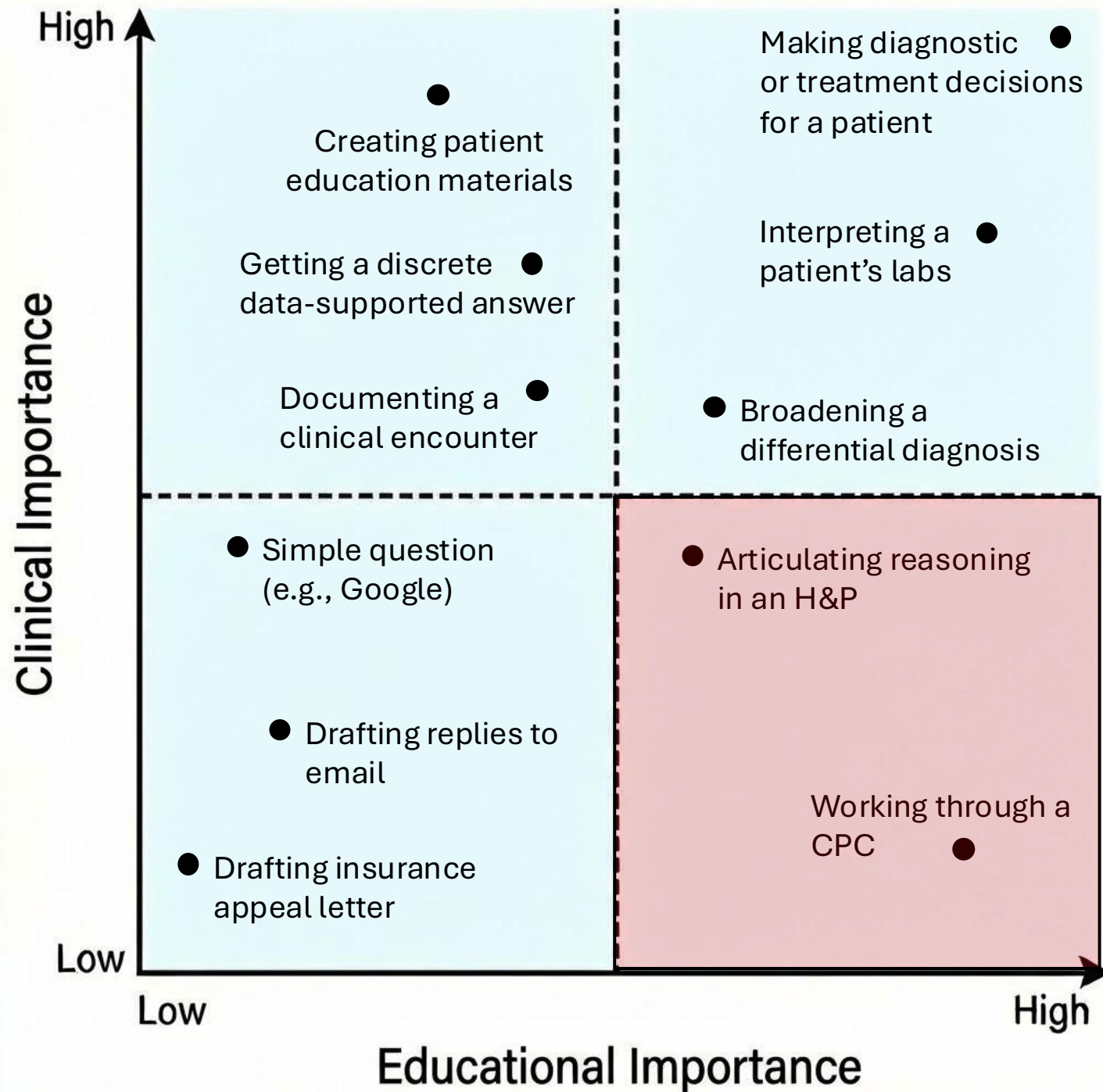
**High/Low =
Verify**

Ok to use AI here, but
important to understand
its limitations and verify
sources/output

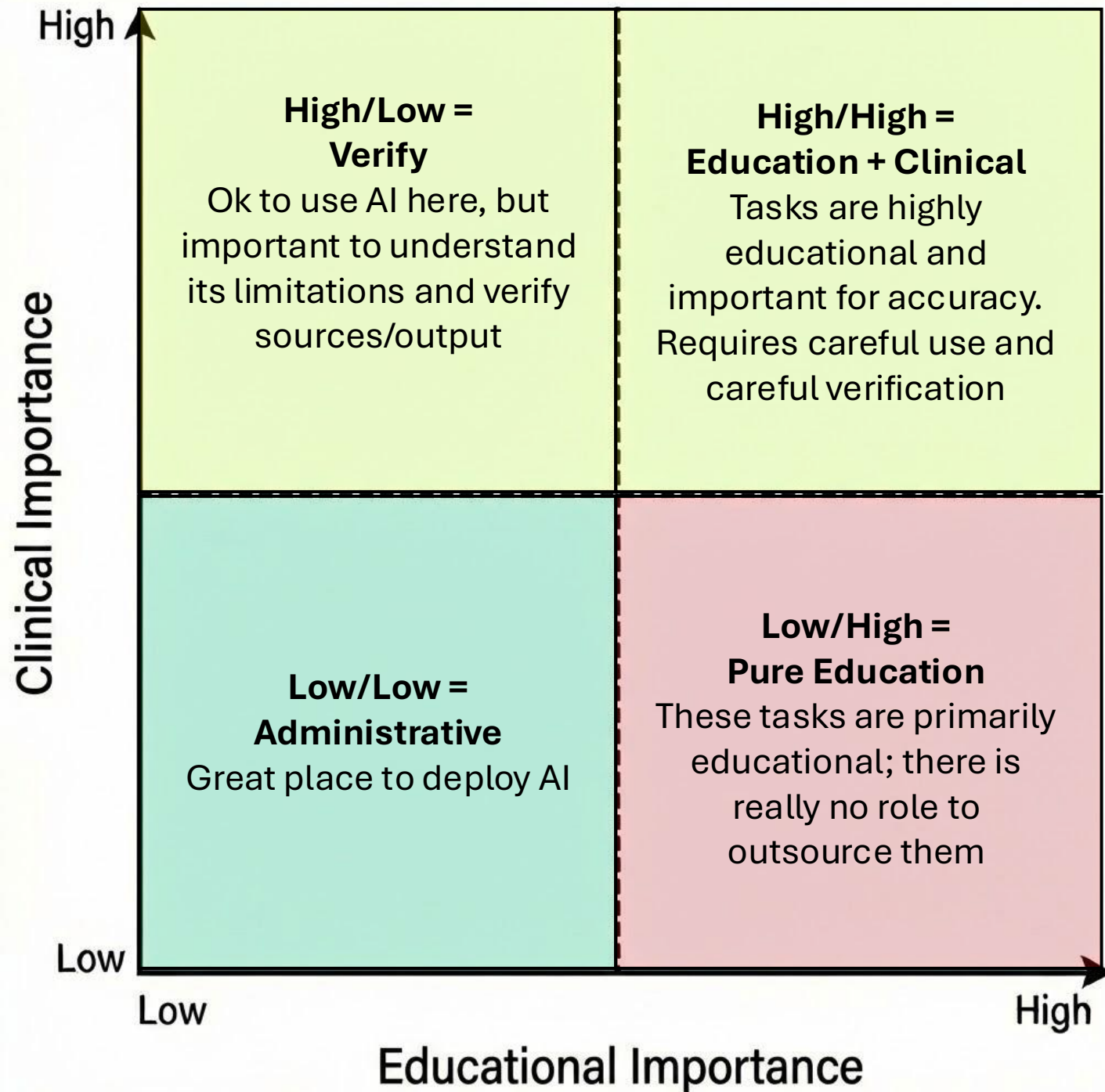


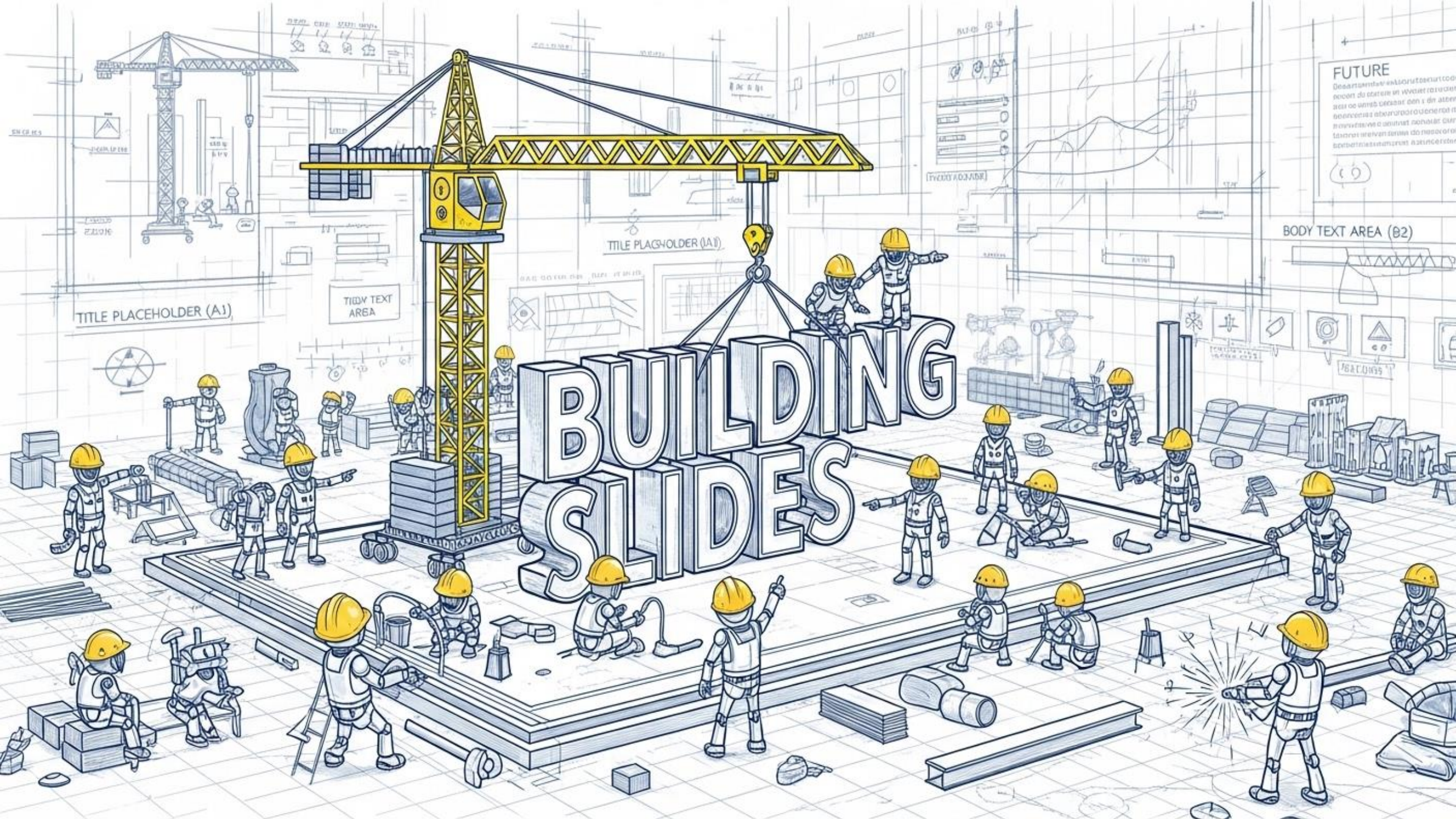


High/High = Education + Clinical
Tasks are highly educational and important for accuracy. Requires careful use and careful verification



Low/High = Pure Education
 These tasks are primarily educational; there is really no role to outsource them





TITLE PLACEHOLDER (A1)

TINY TEXT AREA

TITLE PLACEHOLDER (A1)

BODY TEXT AREA (B2)

FUTURE

Desarrollar el futuro de un proyecto de construcción es un desafío que requiere una visión clara de los objetivos y una planificación cuidadosa. Este espacio está reservado para ideas y conceptos que se desarrollarán en futuras versiones del documento.



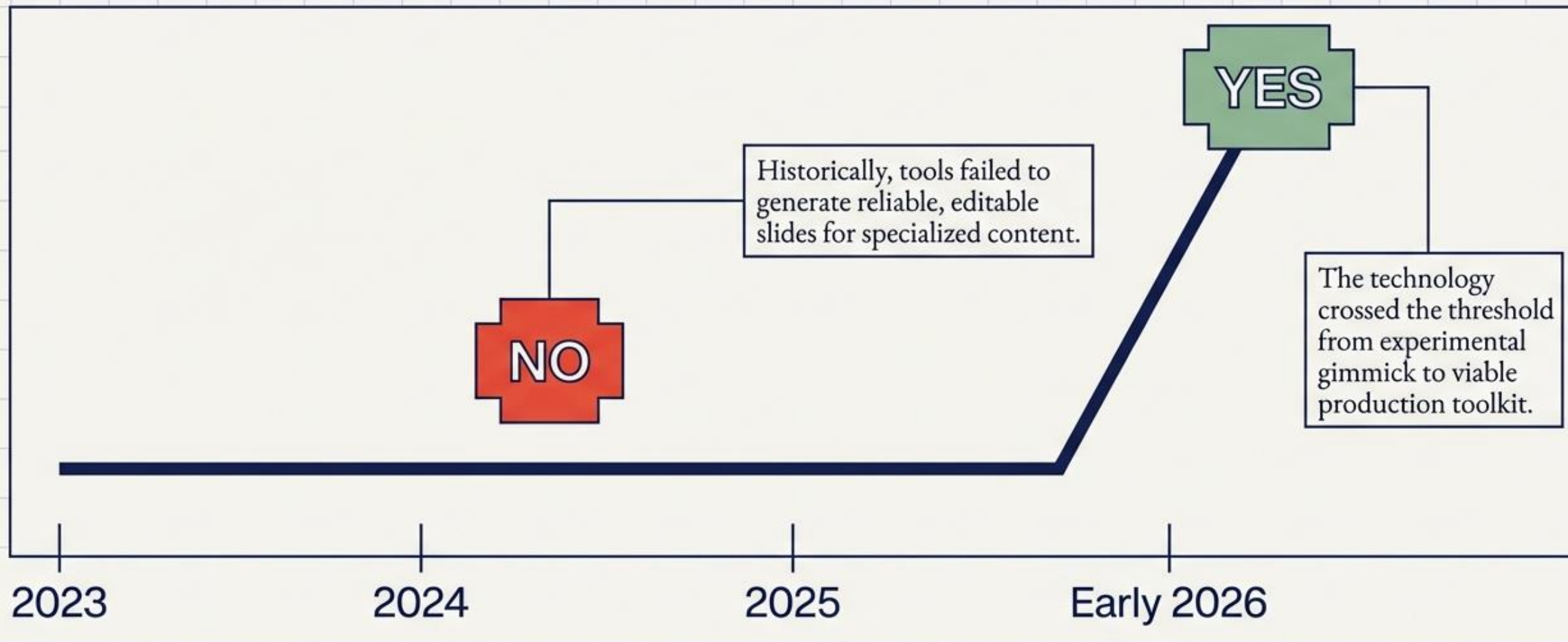
PERCUTING

The rules for building slides with AI changed in 2026.

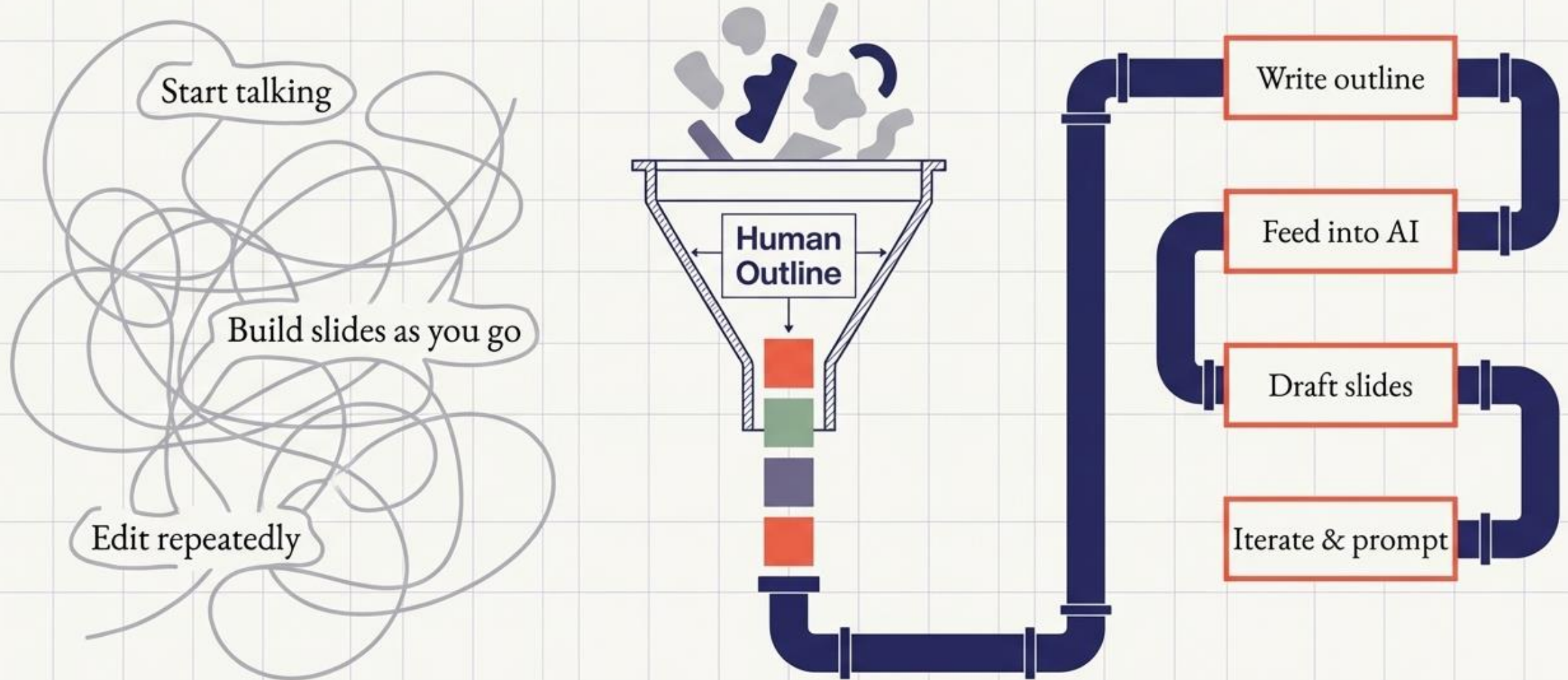


A structural guide to the modern presentation toolkit.

The capability flatline officially broke in early 2026.



Structured output requires structured input.



Cognitive Load Theory in Medical Education

90-Minute Workshop Outline — BMC

Core thesis: Productive friction (germane load) is necessary for learning. AI risks reducing ALL load types — including germane — which is the key educational risk.

Three acts:

1. How the brain learns
2. How teaching design affects that
3. What AI changes — and what we should do

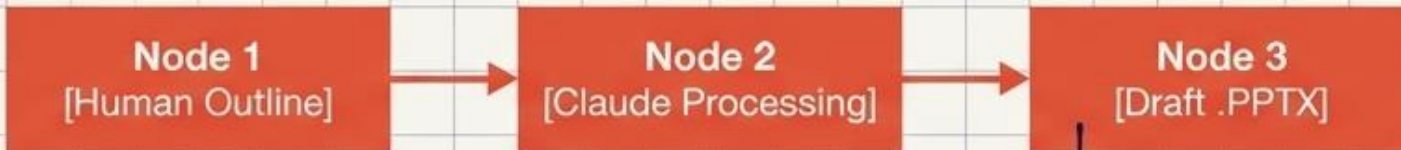
Workshop Structure

#	Section	Time	Format
0	Hook & Setup	5 min	Poll + framing
1	Cognitive Architecture	10 min	Mini-lecture
2	Three Types of Load	10 min	Mini-lecture + Think-Pair-Share
3	The 5 Types of Overload	15 min	Workshop: Fix the Slide
4	Multimedia Design Principles	10 min	Mini-lecture + demo
5	Enter AI: A New Variable	15 min	Mini-lecture + discussion
6	What Should We Do?	15 min	Small group activity + report-back
7	Summary & Q&A	10 min	Discussion

Claude

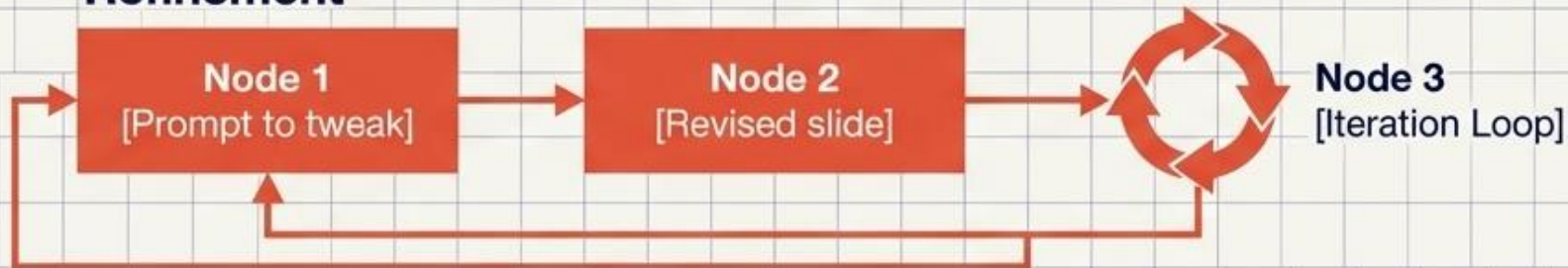
Claude functions as the structural scaffolder.

Generation

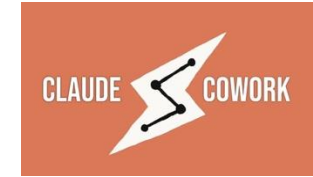
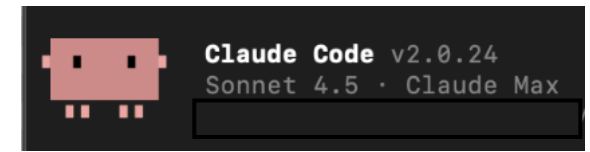
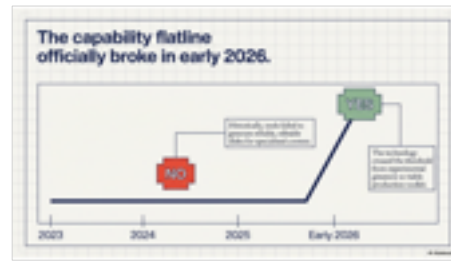
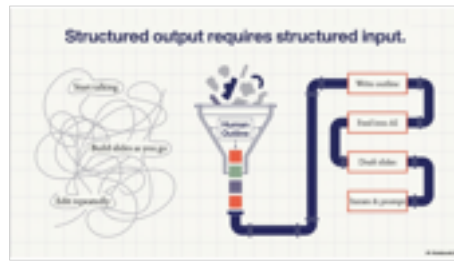
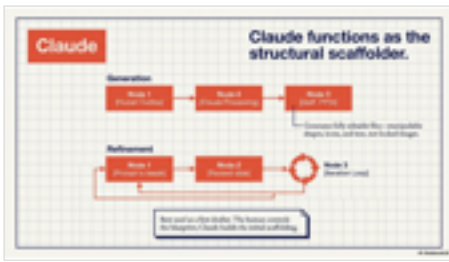


Generates fully editable files—manipulable shapes, icons, and text, not locked images.

Refinement



Best used as a first-drafter. The human controls the blueprint; Claude builds the initial scaffolding.



Jonathan: Let's look in the MedEd_Retreat folder. Can you review the cases and summarize each one in a way it would legibly fit on a PowerPoint slide along with the 2 prompts?

Claude: Found the folder and read Retreat Cases.txt. Here are slide-ready summaries for each case:

...

Do you want me to turn these into PowerPoint slides?

Jonathan: Oh yeah, that would be great

Claude: Built a 5-slide PowerPoint using pptxgenjs:
Title slide — "AI in Medical Education: Case-Based Discussion: When, How, and Should We?"

Case 1 slide

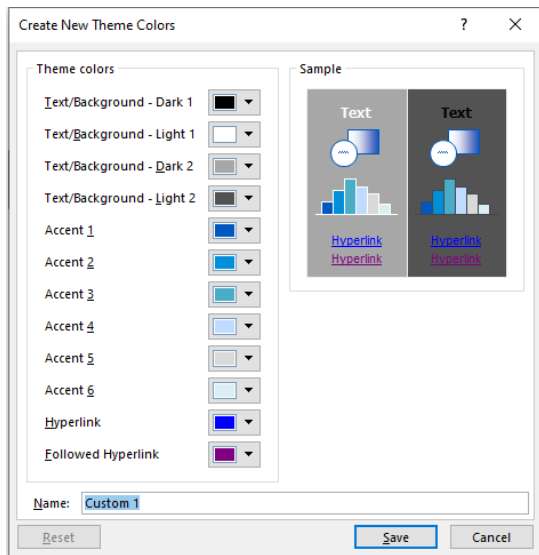
Case 2 slide

Case 3 slide

Discussion Questions slide — all 5 reflection questions with numbered circles

Each case slide had a navy header bar, case summary in a white card, and two prompt boxes side by side (blue and teal). Saved to AI_Cases_Retreat.pptx in this folder.

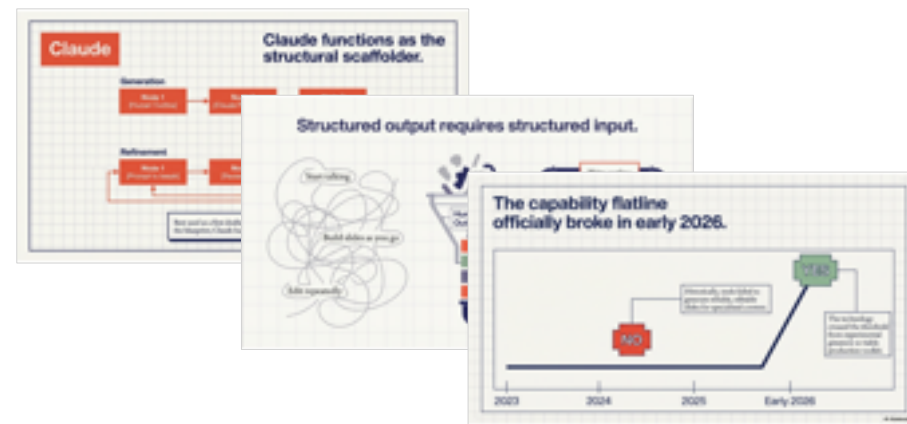
Jonathan: Yeah can we use Aptos for the font and use the theme colors I just sent you a screenshot of?



Claude: Read the theme colors from the screenshot — a blue/teal palette. Asked about the dark slide background color.

Jonathan: White. You can use white for everything.

Claude: Rebuilt the deck with:
Font: Aptos throughout
Backgrounds: White on all slides
Accent colors: Dark navy (#243F60), medium blue (#2E75B6), teal (#17A3BB), and lighter blue tints for prompt box backgrounds
Layout: Blue/teal left accent bars, numbered teal ovals for case badges and discussion questions

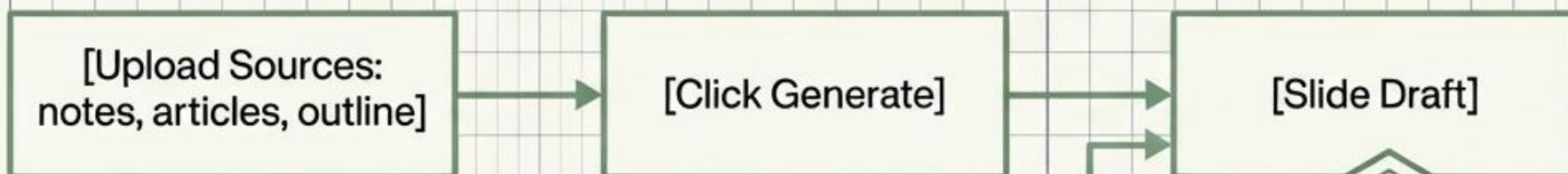


Jonathan: Looks beautiful.

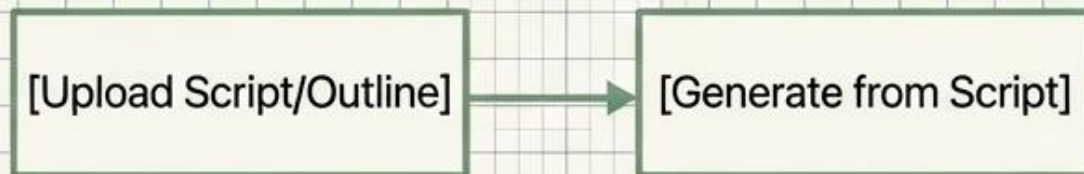
NotebookLM

NotebookLM synthesizes directly from grounded source material.

Generation



Alternative: Finer Control



Grounded Output: Generates slides strictly from your uploaded corpus, preventing external hallucination.



Sources



+ Add sources

Search the web for new sources

Web Fast Research

Select all sources



2410.03703v2.pdf



9 ways to reduce cognitive load in ...



AI & cognitive load.pdf



Ambient AI, cognitive load.pdf



Brit J Educational Tech - 2024 - Fa...



Graphic Design for Clinical Teacher...



Managing the Load: AI and Cogniti...



Medical Education - 2009 - Van M...



Pharmacology multimedia design.p...



Chat



- **Promote Schema Building:** Use structural aids like flowcharts, diagrams, and metaphors to help learners connect new information to existing knowledge ³⁶ .
- **Include Active Prompts:** Integrate **self-explanation prompts** or case studies at the end of sections to force learners to actively process and apply information ³⁷
- **Employ Fading Guidance:** Start with fully worked examples, move to completion tasks with partial solutions, and end with unassisted problems to transition the learner toward expertise ²⁹
- **Act as a "Coach," not a Repository:** Design content that guides users through structured reasoning frameworks (e.g., listing associated words or strategies) rather than providing direct answers to prevent **metacognitive laziness** and cognitive offloading ⁴²

Save to note



How can AI act as a coach for convergent thinking?

What are the risks of AI causing homogenization of ideas?

How does the modality effect help prevent cognitive overload?

Start typing...

13 sources



Studio



Audio Overview



Video Overview

Mind Map

Reports

Flashcards



Quiz



Infographic



Slide Deck



Data Table



Generating Slide Deck... based on 13 sources

Generating Slide Deck... based on 13 sources

Unlocking Deep Learning... 13 sources · 12d ago

Add note

Customize Slide Deck



Format

Detailed Deck ✓

A comprehensive deck with full text and details, perfect for emailing or reading on its own.

Presenter Slides

Clean, visual slides with key talking points to support you while you speak.

Choose language

English ▼

Length

Short

✓ Default

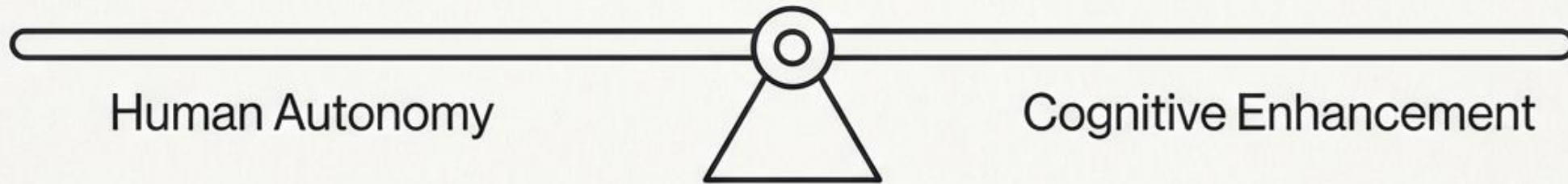
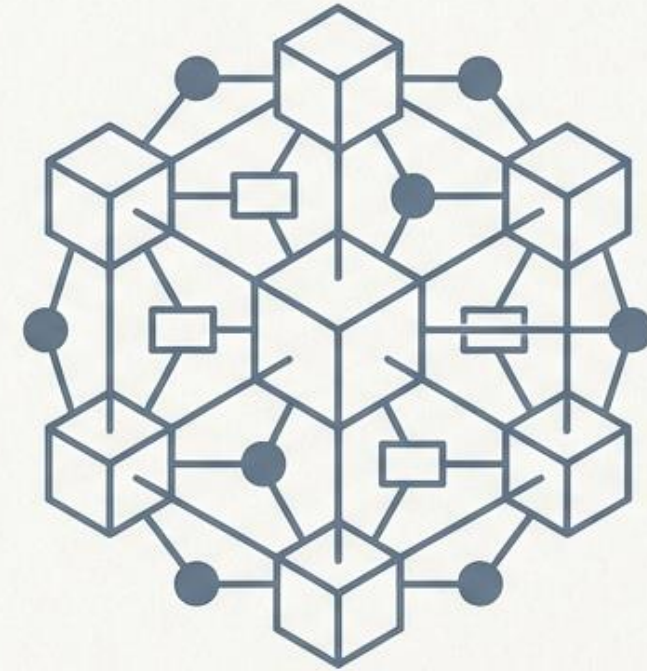
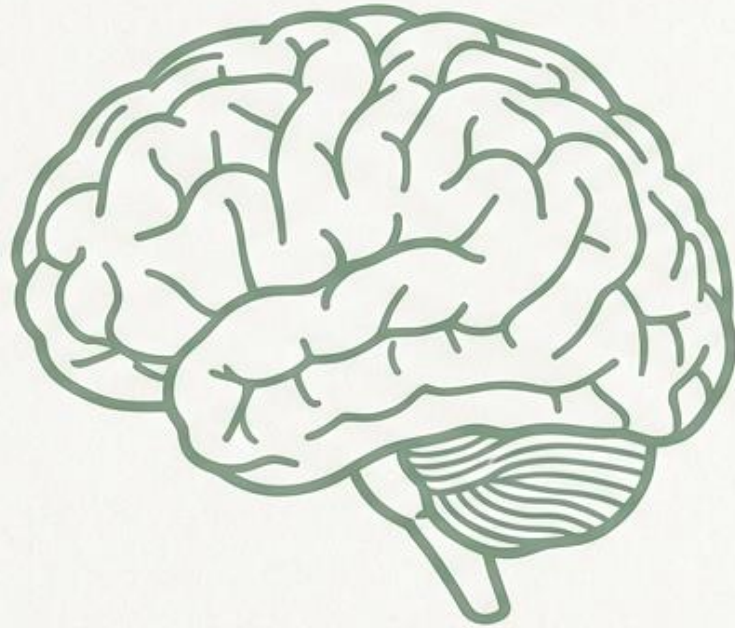
Describe the slide deck you want to create

Add a high-level outline, or guide the audience, style, and focus: "Create a deck for beginners using a bold and playful style with a focus on step-by-step instructions."

Generate

The Cognitive Paradox

Navigating cognitive load, creative homogenization, and the future of assisted learning.



The Double-Edged Sword of Cognitive Assistance



The Promise

Unprecedented productivity, rapid ideation, personalized tutoring, and complex synthesis.

GPT-4 scored **88.1%** on **Medical State Exams** vs. students' **74.6%**.



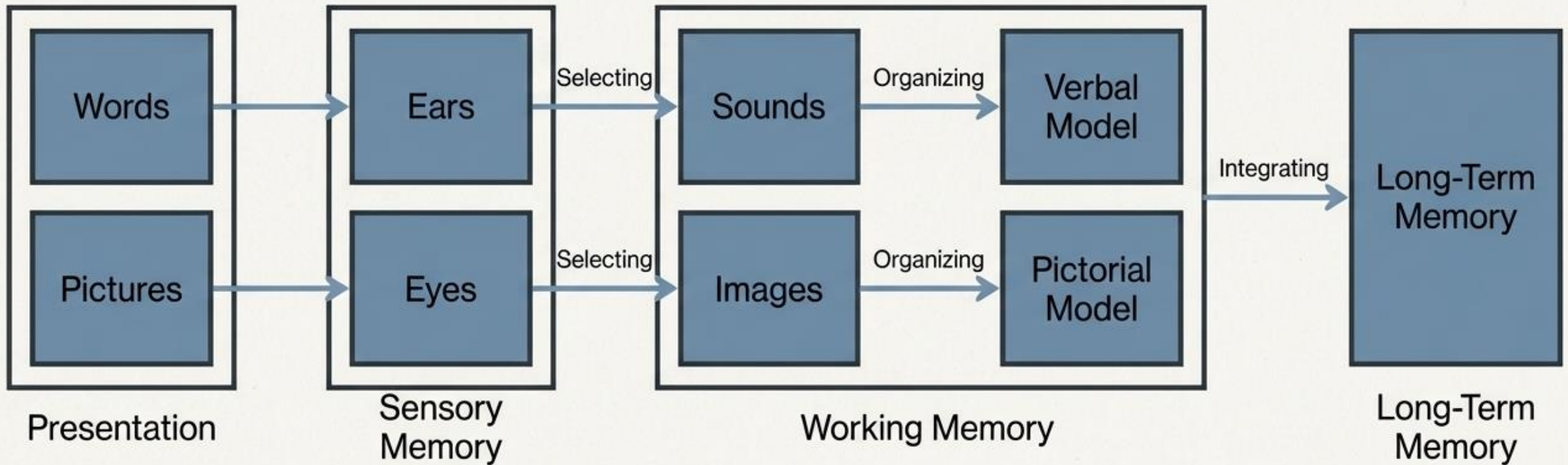
The Peril

Cognitive overload, "offloading" of analytical tasks, creative homogenization, and the degradation of independent reasoning.

Overreliance correlates with **reduced problem-solving ability** ($d = -0.41$).

The Three Pillars of Cognitive Processing

- **Dual Channels:** Separate pathways for visual/pictorial and auditory/verbal data.
- **Limited Capacity:** Working memory bottlenecks.
- **Active Processing:** Meaningful learning requires selecting, organizing, and integrating.



THE COGNITIVE CRUSADER'S GUIDE TO SLIDE DESIGN IN THE AI ERA

MASTER THE 4 DIRECTIVES OF COGNITIVE LOAD THEORY!



CLASSIFIED TRAINING MANUAL: DEFEATING INFORMATION OVERLOAD

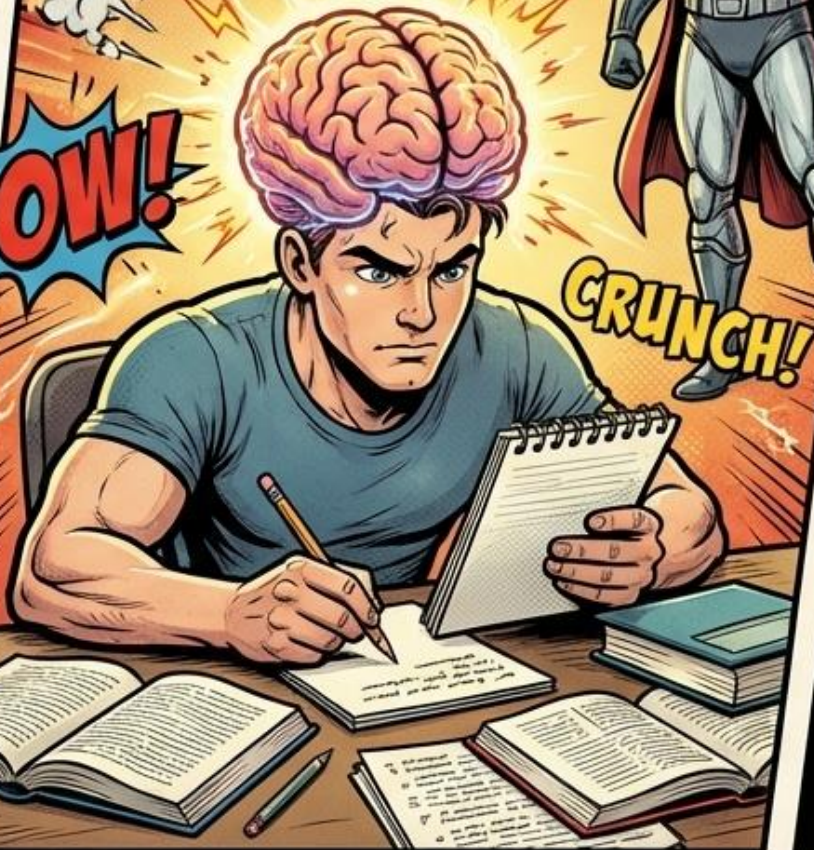
GENERATIVE AI THREATENS TO TRIGGER METACOGNITIVE LAZINESS AND COGNITIVE OFFLOADING

Uncritical reliance on AI leads to cognitive offloading—delegating analytical tasks to external systems.



When we bypass deliberate cognitive effort, we reinforce a state of metacognitive laziness. We must design slides that fight this!

POW!



CRUNCH!



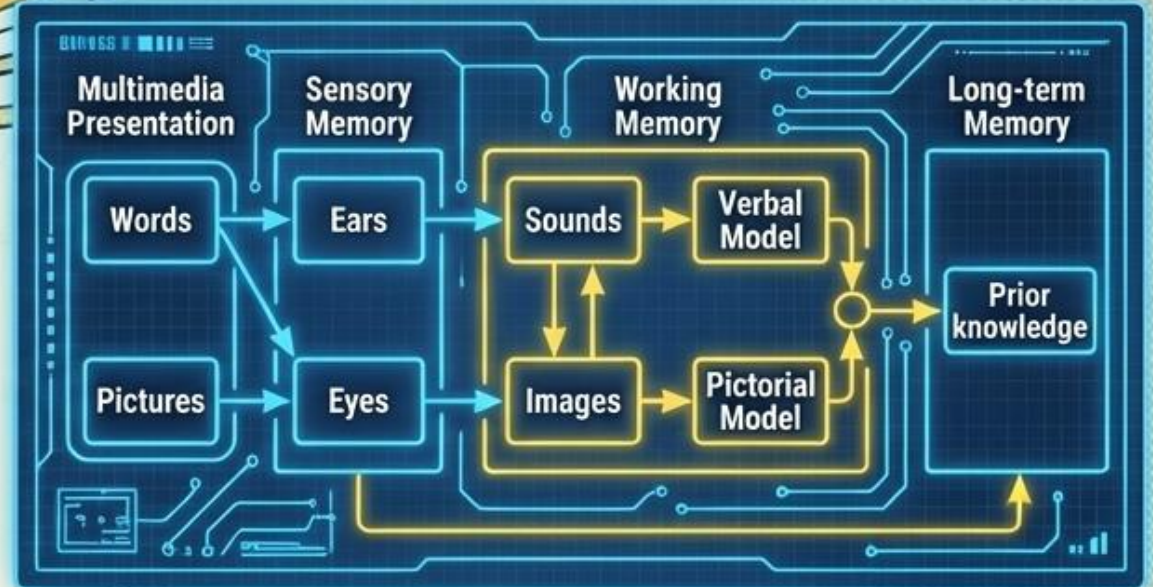
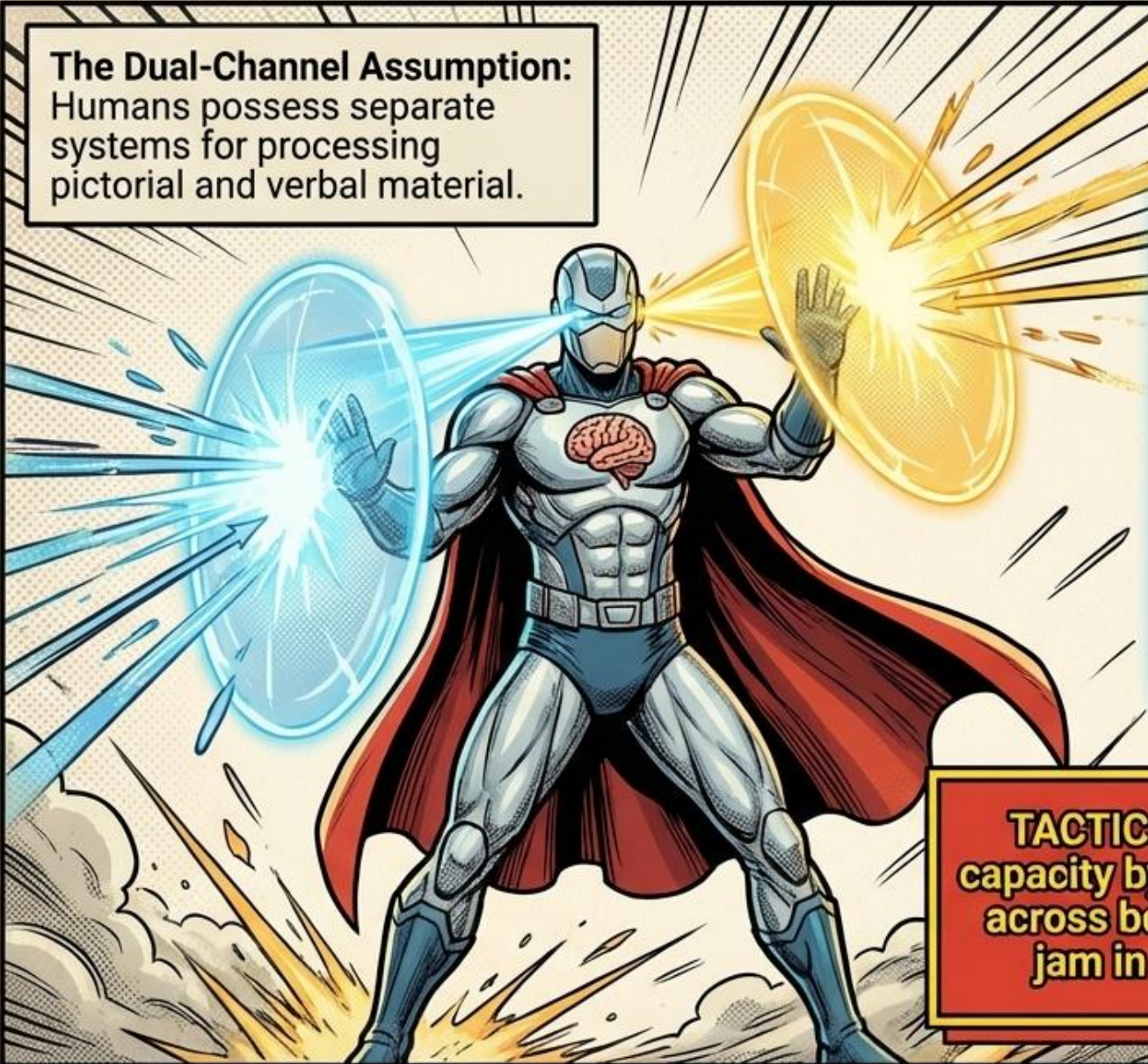
THREAT DETECTED!



WARNING: Excessive dependence on AI dialogue systems correlates with a -0.41 reduction in problem-solving ability!

DESIGN MUST ENGAGE BOTH THE AUDITORY AND VISUAL CHANNELS SIMULTANEOUSLY.

The Dual-Channel Assumption:
Humans possess separate systems for processing pictorial and verbal material.



TACTIC: Maximize processing capacity by distributing information across both channels, avoiding a jam in the visual processor.

Each channel has a strictly limited capacity. Processing bottlenecks lead to catastrophic cognitive overload.

Gemini

Gemini generates custom visual assets when stock imagery fails.

Concepting

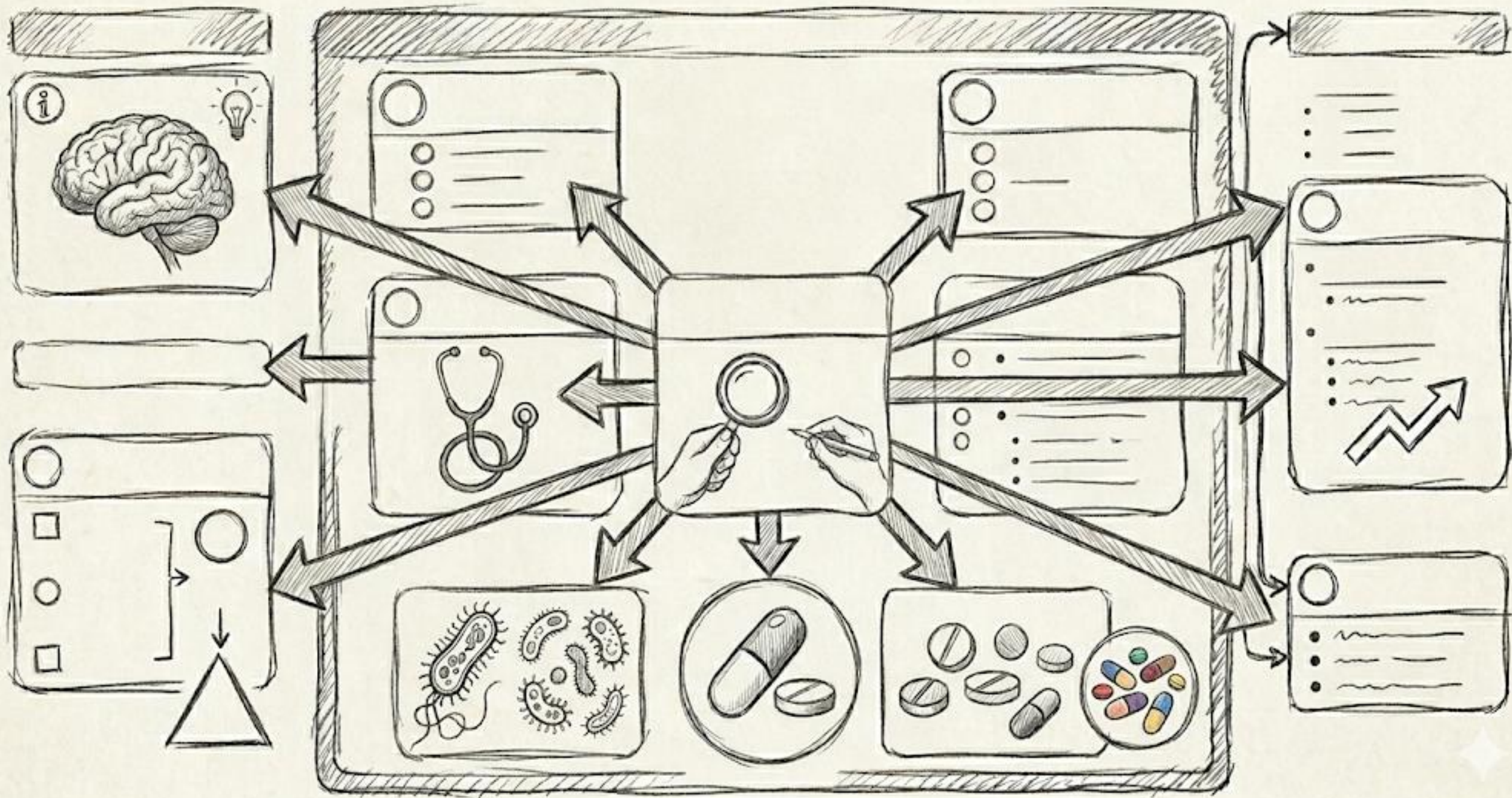


Refine the concept in conversation before generating.

Generation



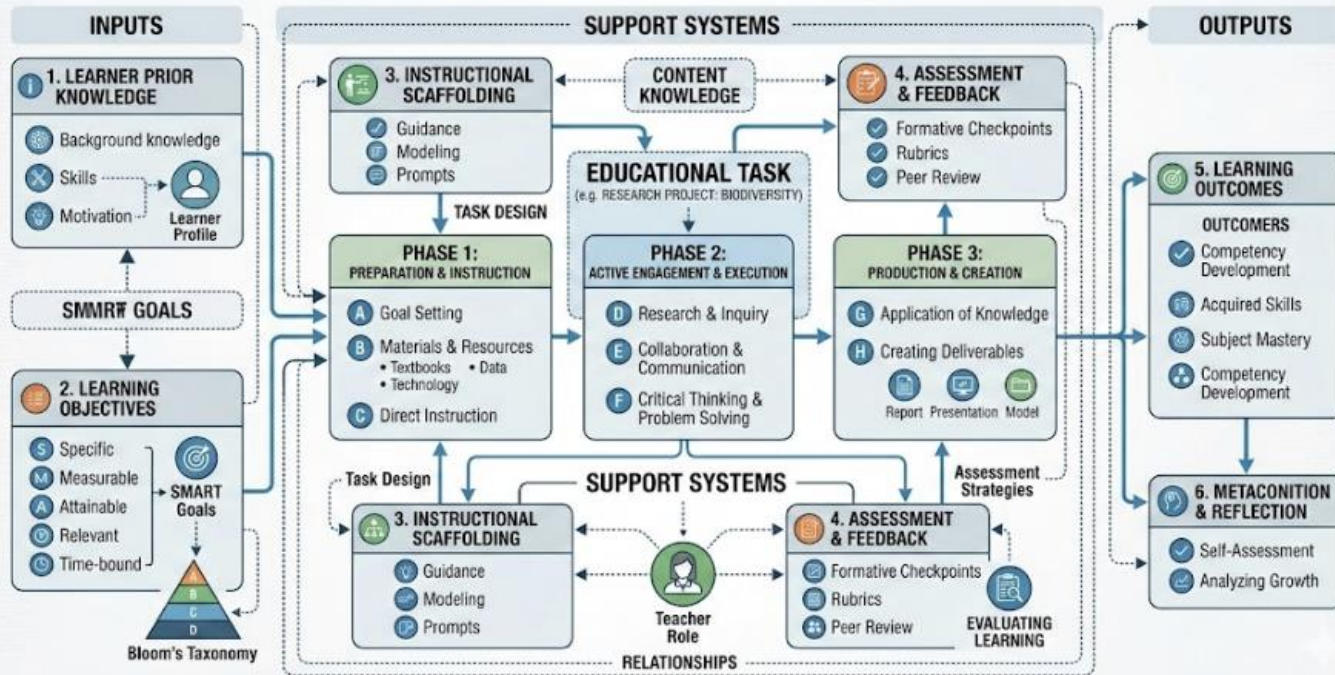
Rarely a one-click process. Requires continuous prompt adjustment and regeneration to achieve precise one-off slide art.



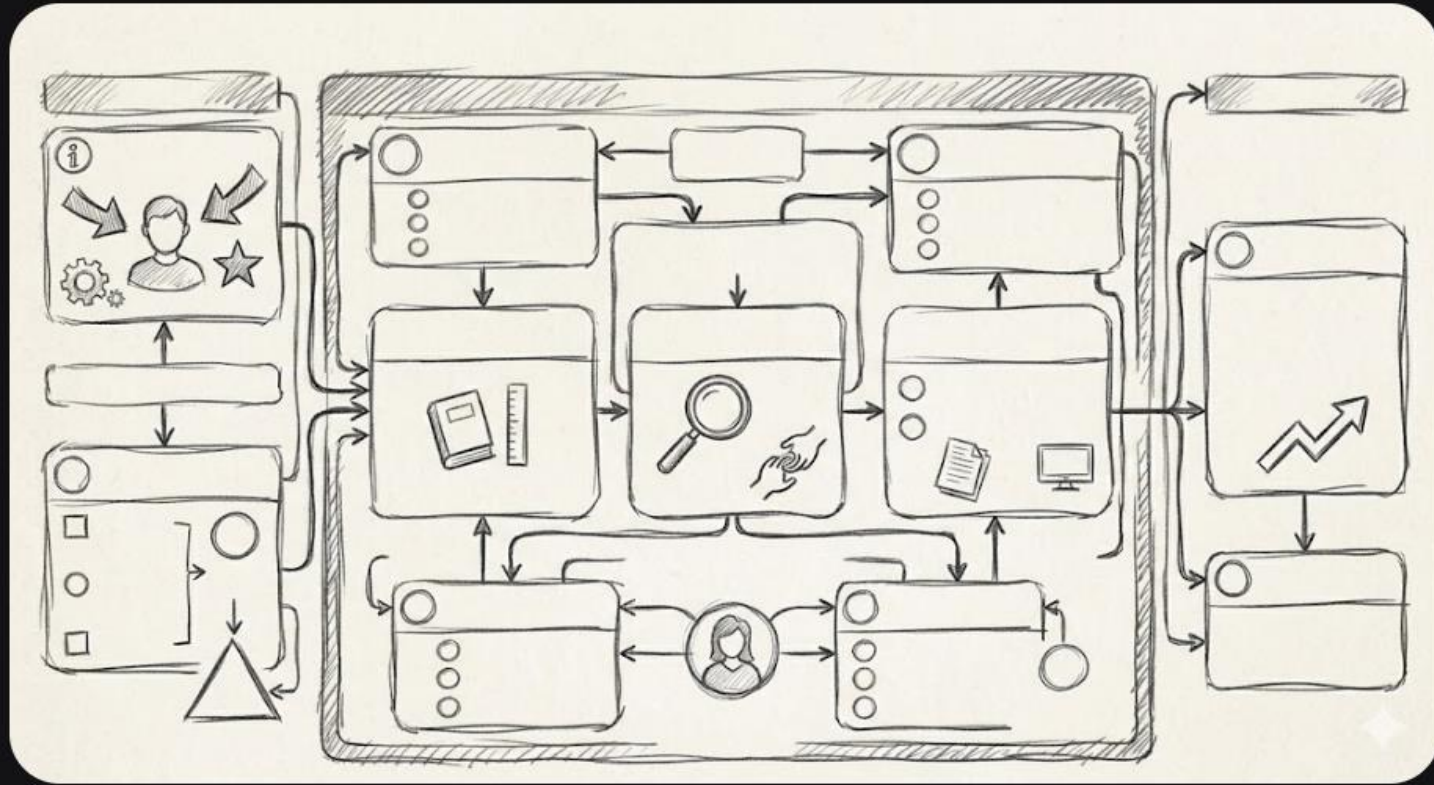


Create an image of a schematic showing all the components of a task and how they relate to education

ANATOMY OF AN EDUCATIONAL TASK: COMPONENTS & PEDAGOGICAL RELATIONSHIPS

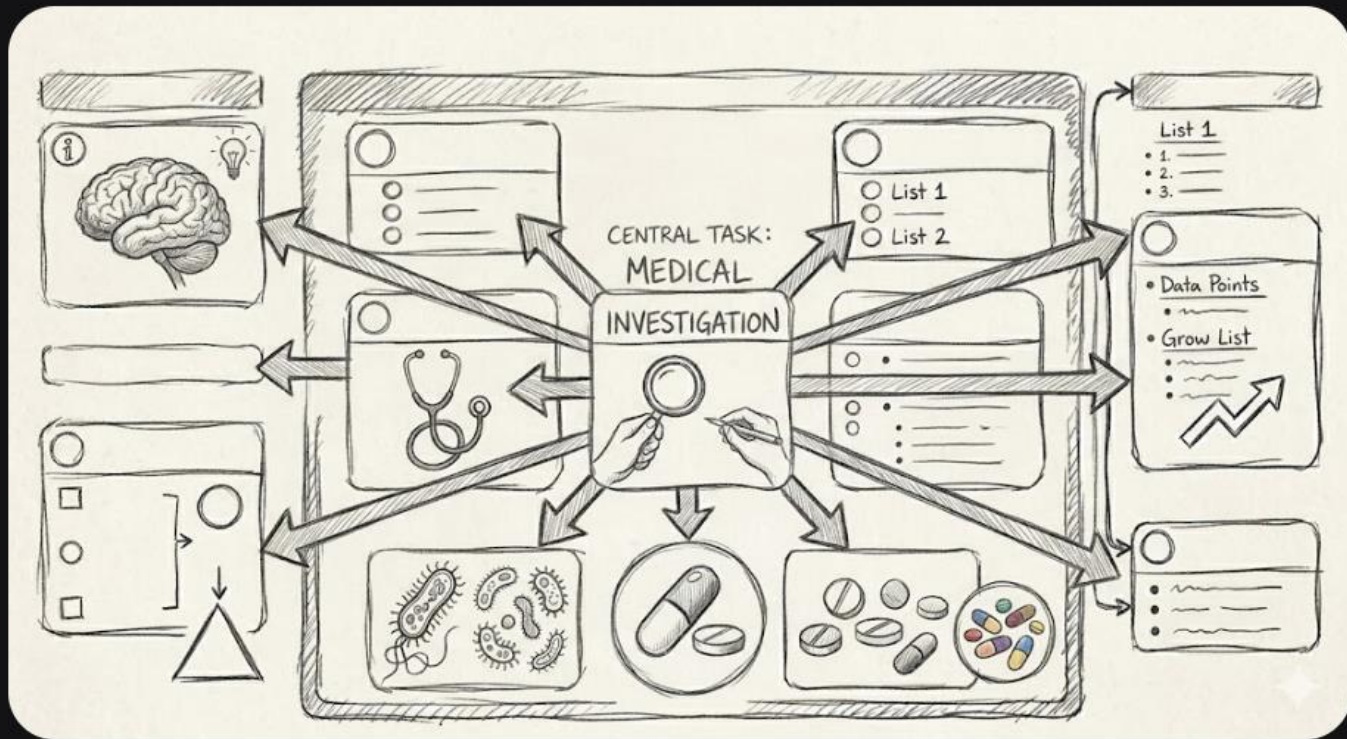


Make it much simpler. It should look handdrawn on paper and should just be large sketches -- no text

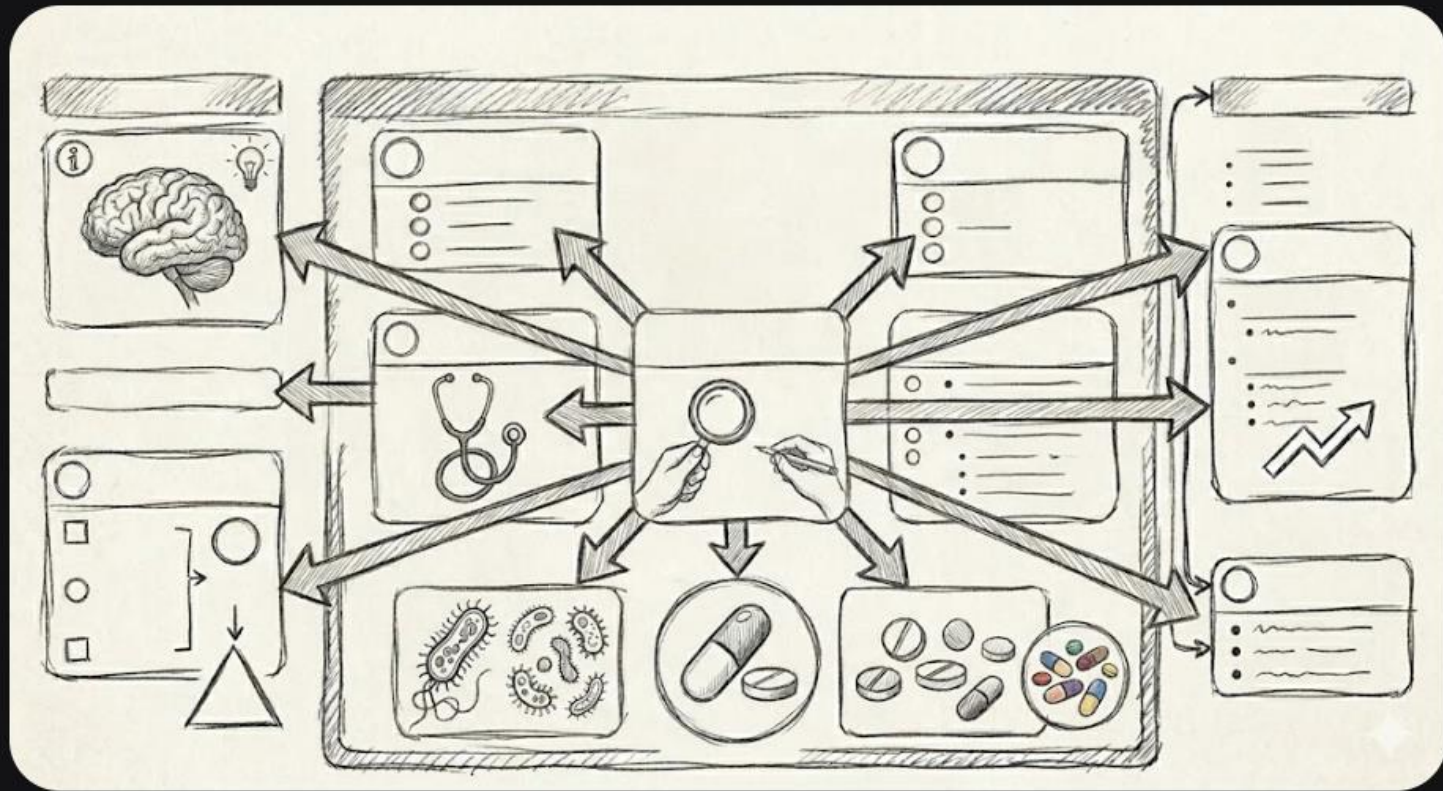







All the arrows should extend outward from a task in the middle. The other sections should show things like a brain, a stethoscope, a bacteria, a pill, a set of lists



Leaving everything else the same, remove all text



The Tool Selection Diagnostic

TOOL	BEST FOR	IDEAL INPUT	OUTPUT FORMAT	THE "AHA" USE CASE
 Claude	Structure	Human Outline	Editable PPTX	First-drafting a full talk.
 NotebookLM	Synthesis	Existing Corpus/Notes	Grounded Slide Draft	Synthesizing heavy literature into a presentation.
 Gemini	Visuals	Concept Description	Custom Image File	Creating specific, one-off slide art.

Dual Channel

Music Speech Sounds
↓ ↓ ↓
Auditory

Text Graphics
↓ ↓
Visual



Limited Capacity

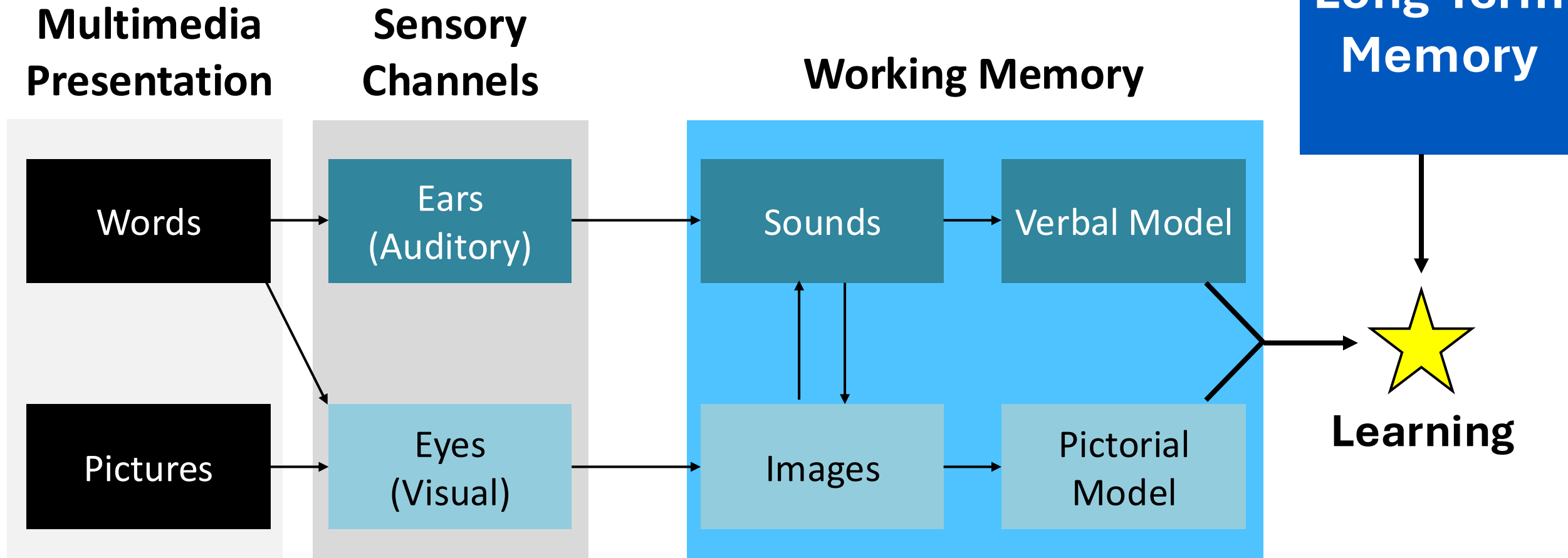
Music Speech Sounds
↓ ↓ ↓
Auditory



Text Graphics
↓ ↓
Visual

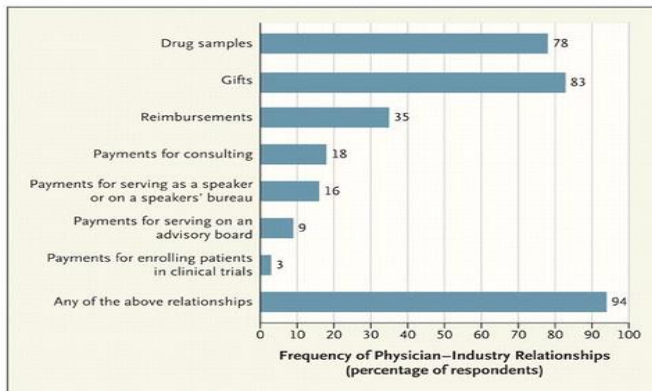


Active Processing



Adapted from Meyer. MedEd. 2010.

Choose 2



1

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed diam nonummy nibh euismod tincidunt ut laoreet dolore magna aliquam erat volutpat. Ut

2



3

Cognitive Load Theory

Intrinsic Load

Extraneous Load

Germane Load

Manage

Minimize

Maximize

Guide
attention

Eliminate
distractions

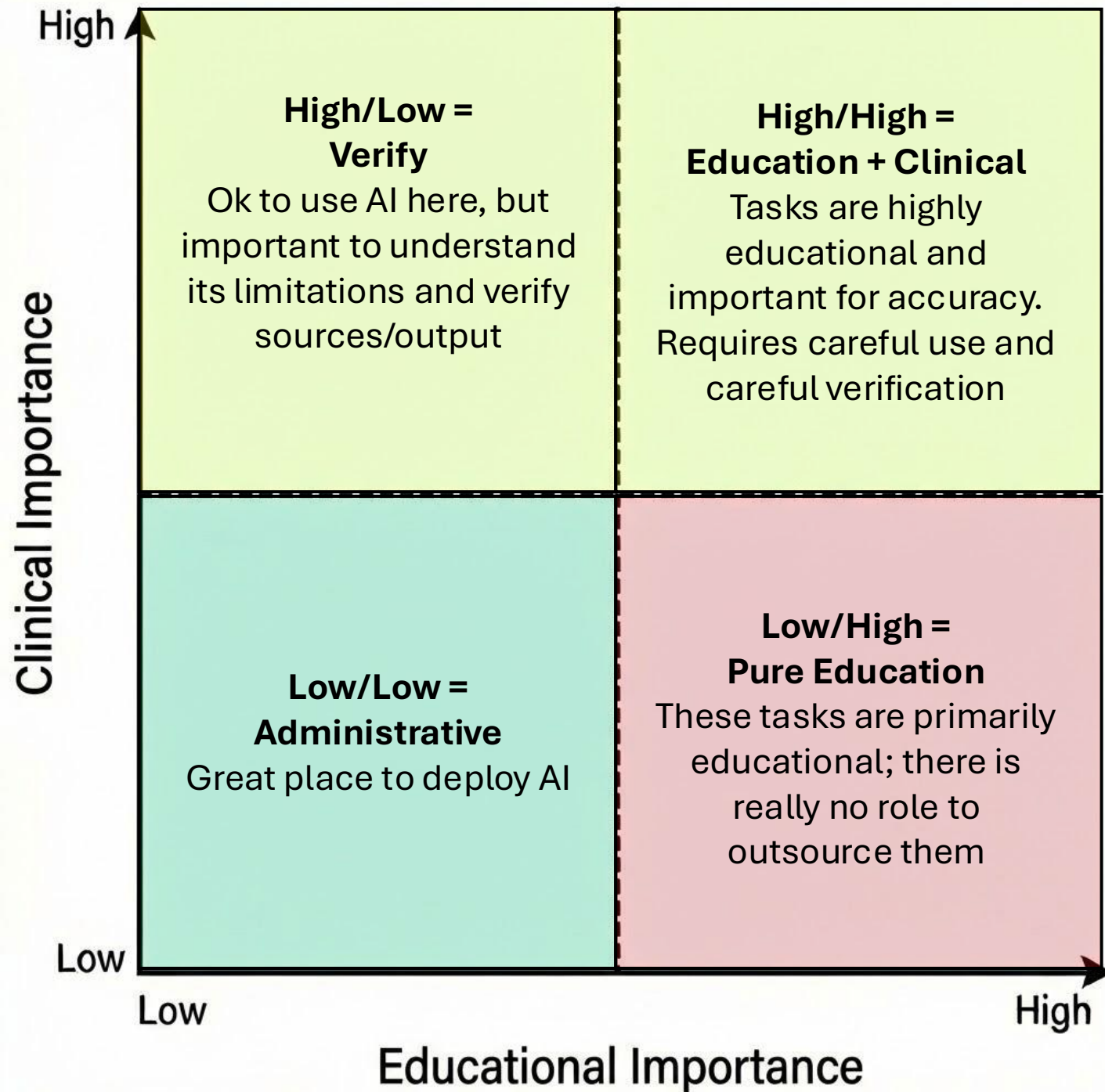
Encourage
effort

Cognitive Overload




Too much on the page	Type 1	Remove text & describe
Too complex	Type 2	Chunking or pretraining
Extraneous material	Type 3	Eliminate extraneous material
Atypical or difficult to interpret data	Type 4	Present data in clear and standard form
Too many abbreviations	Type 5	Be careful of acronyms and define them 3 times

Table 1. Demographic and Clinical Characteristics of the Patients at Baseline.*

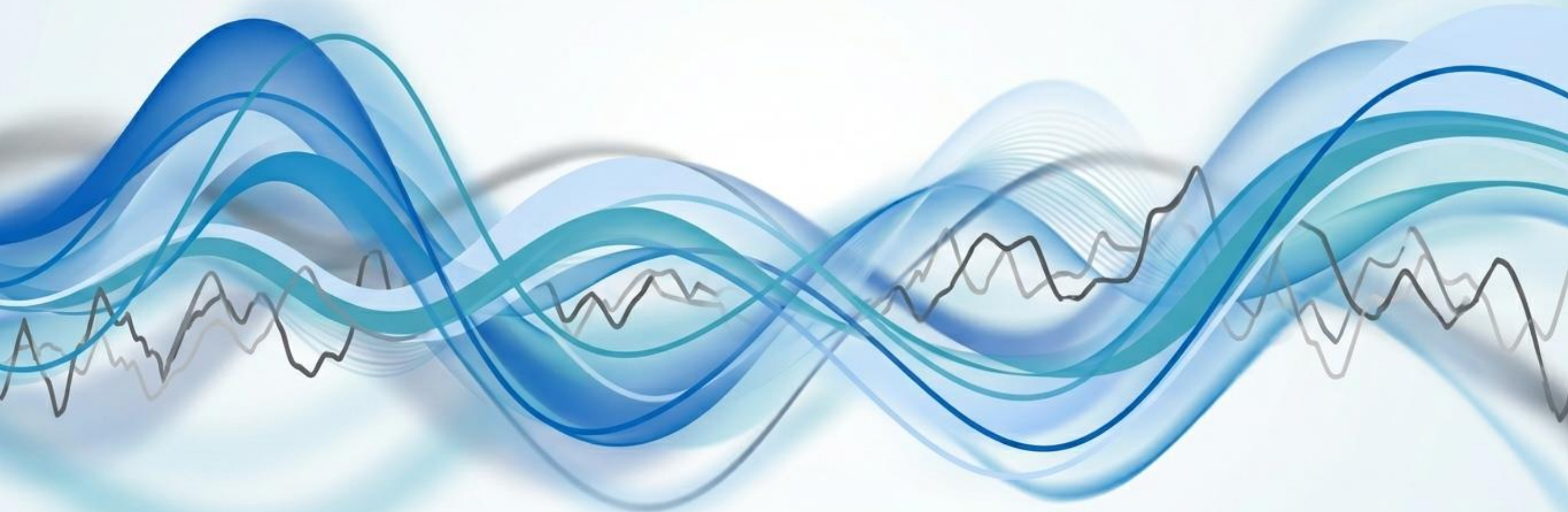
Characteristic	Apixaban (N = 1345)	Rivaroxaban (N = 1355)
Age — yr	58.0±16.3	58.5±15.8
Female sex — no. (%)	597 (44.4)	578 (42.7)



The Tool Selection Diagnostic

TOOL	BEST FOR	IDEAL INPUT	OUTPUT FORMAT	THE "AHA" USE CASE
 Claude	Structure	Human Outline	Editable PPTX	First-drafting a full talk.
 NotebookLM	Synthesis	Existing Corpus/Notes	Grounded Slide Draft	Synthesizing heavy literature into a presentation.
 Gemini	Visuals	Concept Description	Custom Image File	Creating specific, one-off slide art.

Thanks for Listening!



Jonathan Berry
jlberry@bidmc.harvard.edu

