

# Making Thinking Visible

*Teaching Clinical Reasoning to Your Learners*

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**Professional Development Series 8/12/26**

QR Code to  
Evaluation and CME credit



# By the end of this hour, you will be able to...

1

Explain dual process theory — and why your expert reasoning is invisible to learners

2

Use problem representation & illness scripts to diagnose where a learner's reasoning breaks down

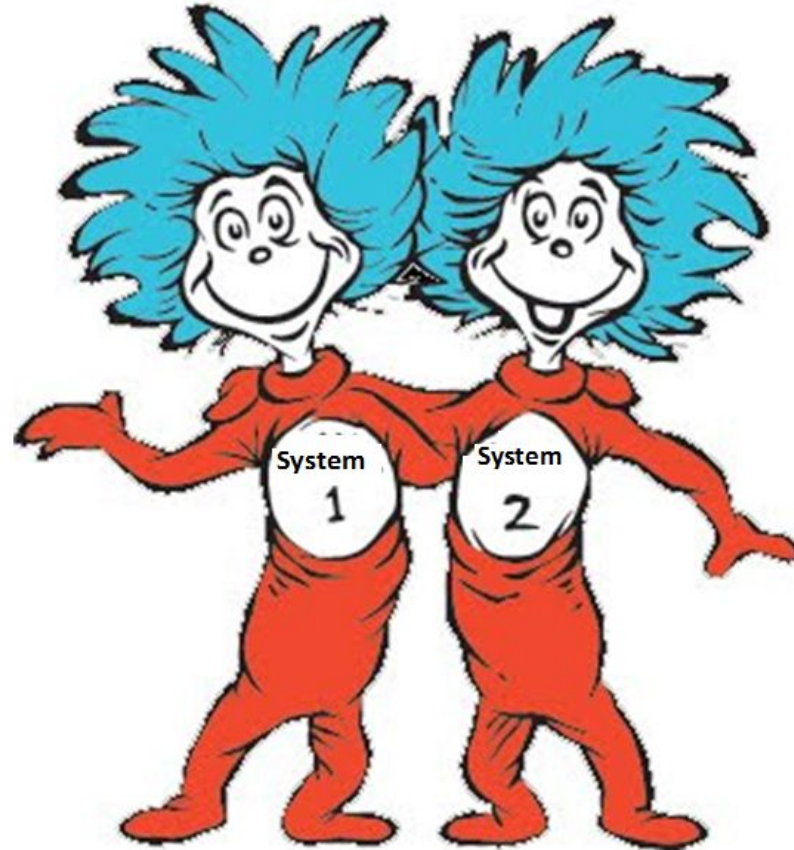
3

Apply discussion based learning questioning—framework to make reasoning explicit

4

Coach learners to recognize and mitigate the cognitive biases behind diagnostic error

# Dual process theory



*Two distinct — but integrated — “systems” behind every clinical decision.*

WHAT DO YOU SEE?

YOUR TURN





## THE HIDDEN TIGER



*Once you've seen it, you can't unsee it. That is pattern recognition — built by exposure.*

WHAT DO YOU SEE?

YOUR TURN



*Now who sees it?*



# System 1: What animal is this?

## SYSTEM 1

- Rapid pattern recognition — first impressions
- Built from experience and prior knowledge
- Minimal cognitive effort → highly efficient
- Susceptible to context and bias



# System 2: And this?



## SYSTEM 2

- Conscious, systematic, hypothesis-driven
- Slow — requires deliberate cognitive effort
- Engages when the pattern doesn't fit: atypical, complex, new
- Less susceptible to bias



# Shout the diagnosis

1

*“Fever, right upper quadrant pain, jaundice”*

*No differential. No deliberation. The answer arrived before you decided to think.*

# Shout the diagnosis

1

*“Fever, right upper quadrant pain, jaundice”*

2

*“Worst headache of my life”*

*No differential. No deliberation. The answer arrived before you decided to think.*

# Shout the diagnosis

1

*“Fever, right upper quadrant pain, jaundice”*

2

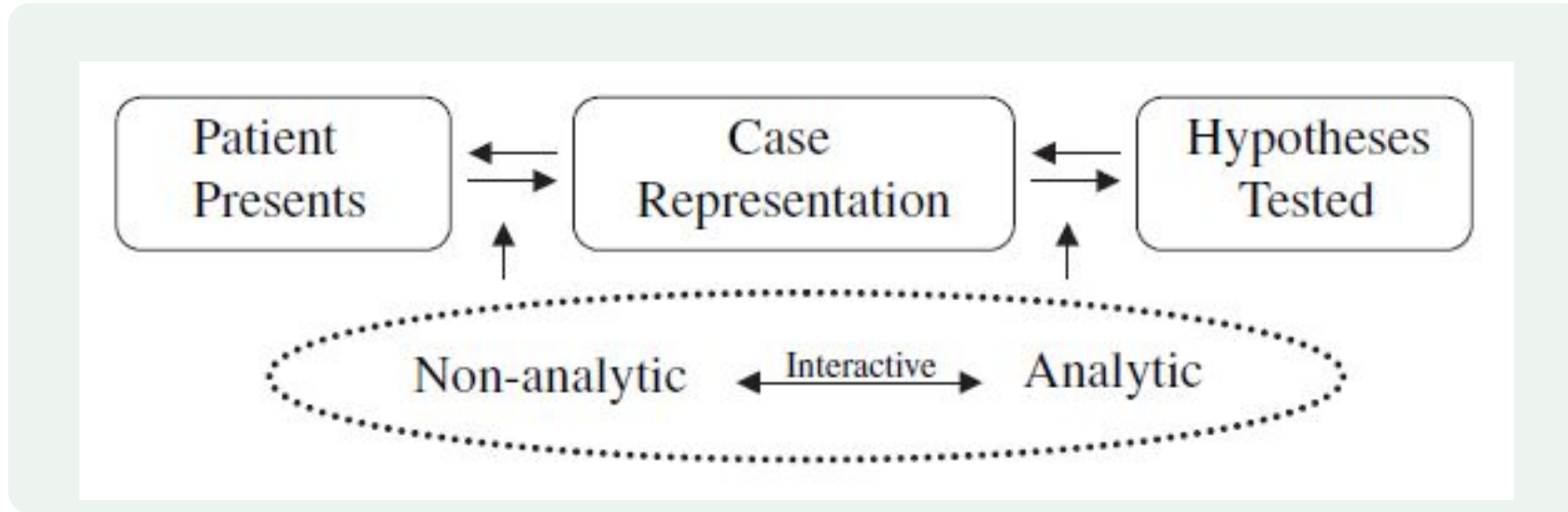
*“Worst headache of my life”*

3

*“Painless jaundice in a 70-year-old”*

*No differential. No deliberation. The answer arrived before you decided to think.*

# Master clinicians toggle — constantly



- The reasoning process is dynamic — intuitive and analytic modes interact (Eva 2005)
- Your mix of knowledge, context, and experience with this presentation dictates how much of each you use
- The teachable skill: noticing when to slow down and check the gut, role modeling your thoughts out loud



# Why is teaching clinical reasoning so difficult?

- **Your thinking process becomes deeply ingrained with experience**
- **Therefore: it is invisible to your learners**
- They see the conclusion, never the path — “get the CT, order the lasix” looks like magic
- And the stakes are real: most patients will experience at least one meaningful diagnostic error in their lifetime (NASEM)
- The good news: faculty development in teaching reasoning measurably changes teaching behavior (Dhaliwal)

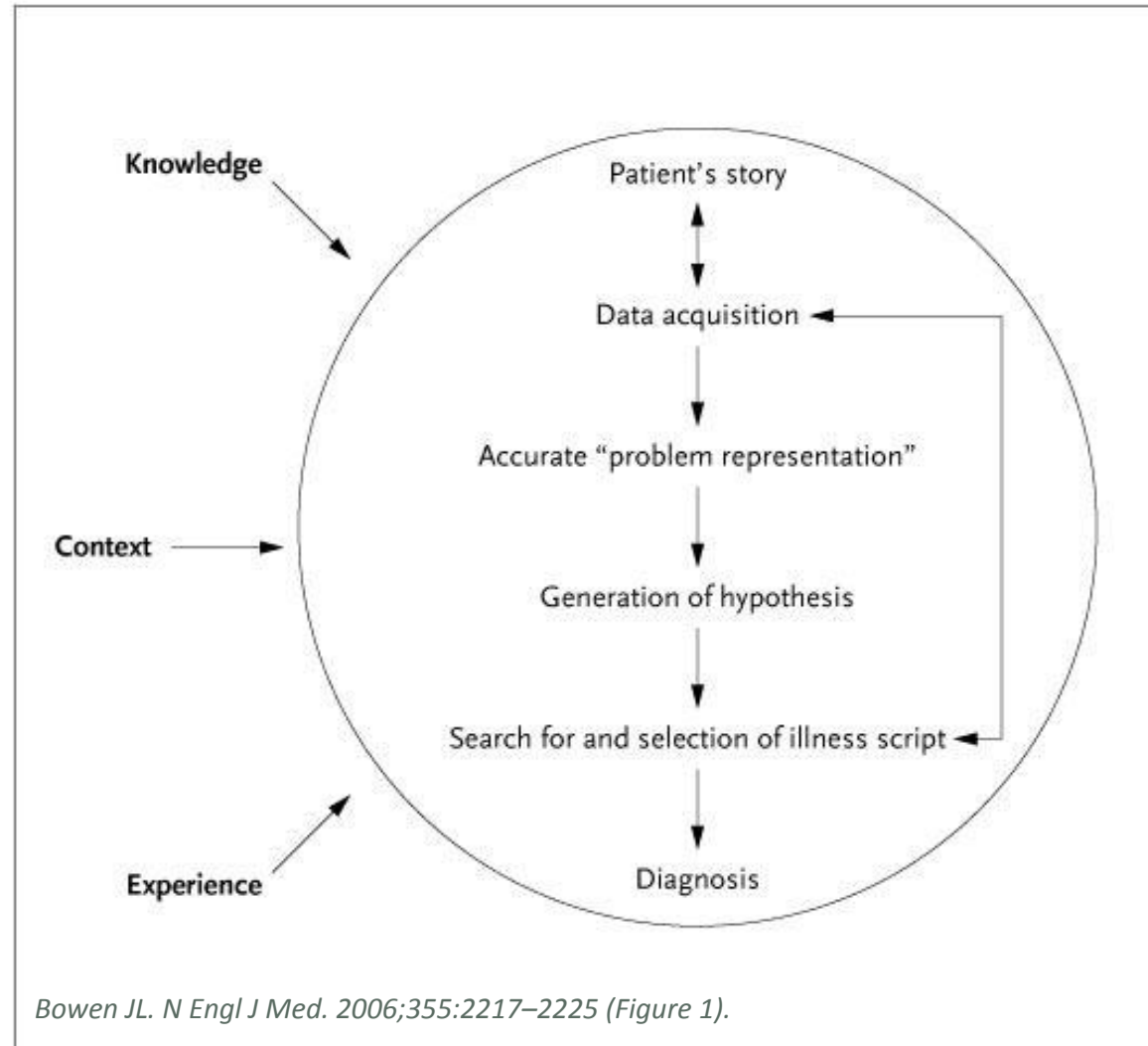


## THE PROBLEM

How do you get from A to B?



# From patient's story to diagnosis



# “My knee hurt so much last night...”

## The Case as Seen by a Novice Resident and an Expert Resident.

**Patient's story:** My knee hurt me so much last night, I woke up from sleep. It was fine when I went to bed. Now it's swollen. It's the worst pain I've ever had. I've had problems like this before in the same knee, once 9 months ago and once 2 years ago. It doesn't bother me between times.

**You're the preceptor.** Two residents saw this patient — a novice and an expert. How would each one present a one-liner.

# Write both presentations

## The Case as Seen by a Novice Resident and an Expert Resident.

**Patient's story:** My knee hurt me so much last night, I woke up from sleep. It was fine when I went to bed. Now it's swollen. It's the worst pain I've ever had. I've had problems like this before in the same knee, once 9 months ago and once 2 years ago. It doesn't bother me between times.

1

### NOVICE- one person

Write the presentation you'd expect from an early clinical learner just saw this patient.

2

### EXPERT- one person

Write the presentation you'd expect from an advanced clinical learner just saw this patient.

3

### COMPARE

What differs? Circle the words in the expert version that do the diagnostic work.



# Same patient. Two presentations.

## NOVICE

**Novice resident's presentation:** My next patient is a 54-year-old white man with knee pain. It started last night. He does not report any trauma. On examination, his vital signs are normal. His knee is swollen, red, and tender to touch. It hurts him a lot when I test his range of motion. He's had this problem twice before.

## EXPERT

**Expert resident's presentation:** My next patient is a 54-year-old white man with a sudden onset of pain in his right knee that awakened him from sleep. He does not report any trauma and was essentially asymptomatic when he went to bed. His history is remarkable for two episodes of similar, severe pain 9 months and 2 years ago. He is pain-free between episodes. He is afebrile today. His knee is swollen, tender to touch, and erythematous.

**What did the expert DO with the data?**

*Sudden onset · awakened from sleep  
· recurrent (two episodes) ·  
asymptomatic between · afebrile ·  
monoarticular*

# The problem representation

A one-sentence representation of the case: age & risk factors + acuity/frequency + clinical syndrome — in medical education language, using semantic qualifiers.

Semantic qualifiers are the retrieval keys required for accurate illness script acquisition:

acute ↔ chronic

exertional ↔ at rest

pleuritic

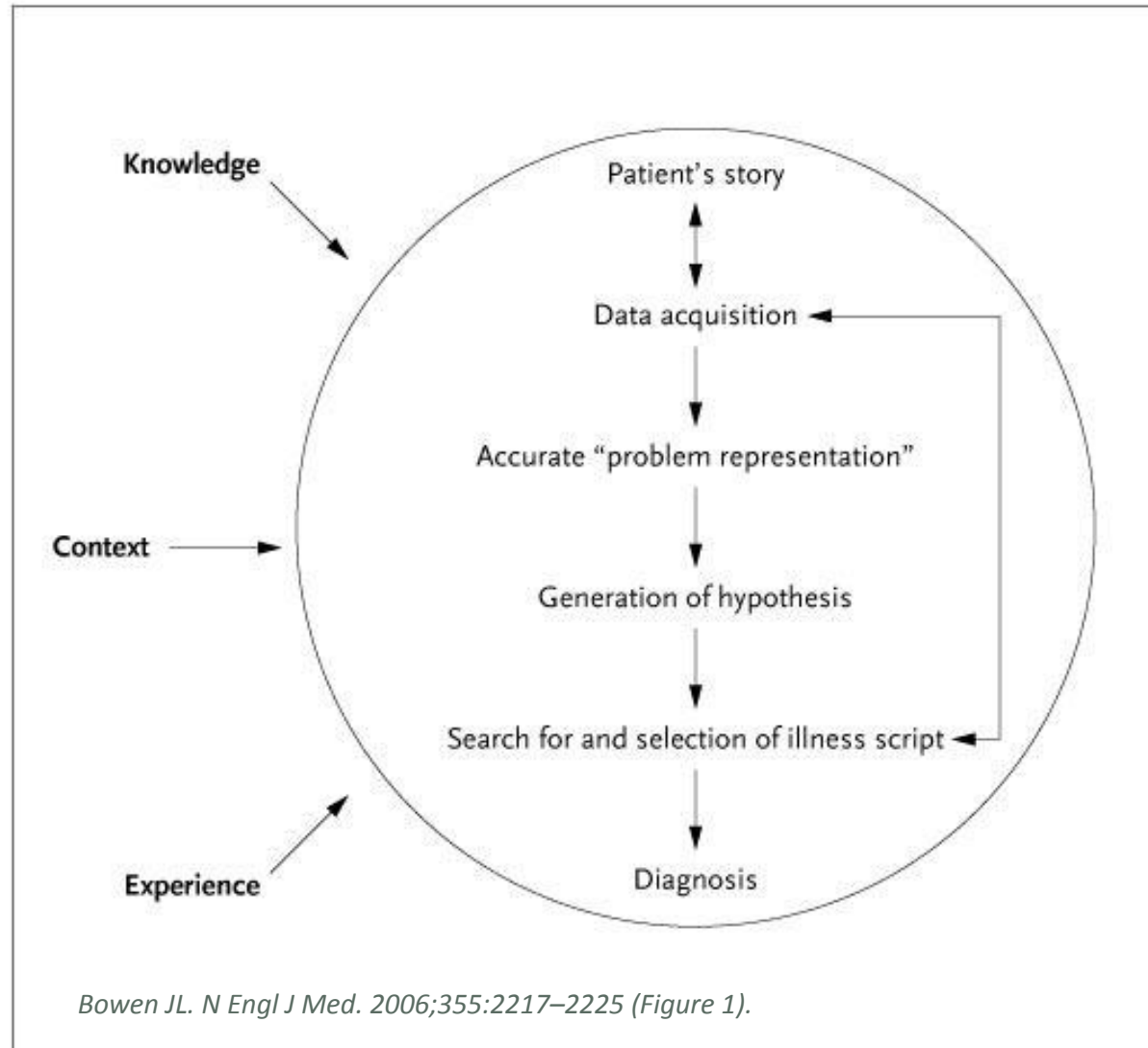
recurrent

progressive

monoarticular ↔ poly

*The knee case, one line: “acute, recurrent, monoarticular knee pain in an otherwise healthy middle-aged man”*

# From patient's story to diagnosis- what is it?



# Illness scripts: how experts store diagnoses

## PREDISPOSING CONDITIONS

*Who gets it?*

Middle-aged man, diuretic use, alcohol, metabolic syndrome

## PATHOPHYSIOLOGIC INSULT

*What's happening?*

Urate crystal deposition → acute crystal-induced inflammation

## CLINICAL CONSEQUENCES

*What does it look like?*

Acute, recurrent, extremely painful monoarthritis — classically 1st MTP, red and hot

*Example: gout*

**Scripts are built by experience:** formal knowledge + repeated patient exposure. Novices have textbook knowledge but thin scripts — that's why they need coached experience, exposure to our thought process, not just reading.

# What's the DDx?: Same patient. Two differentials.

## NOVICE — the list

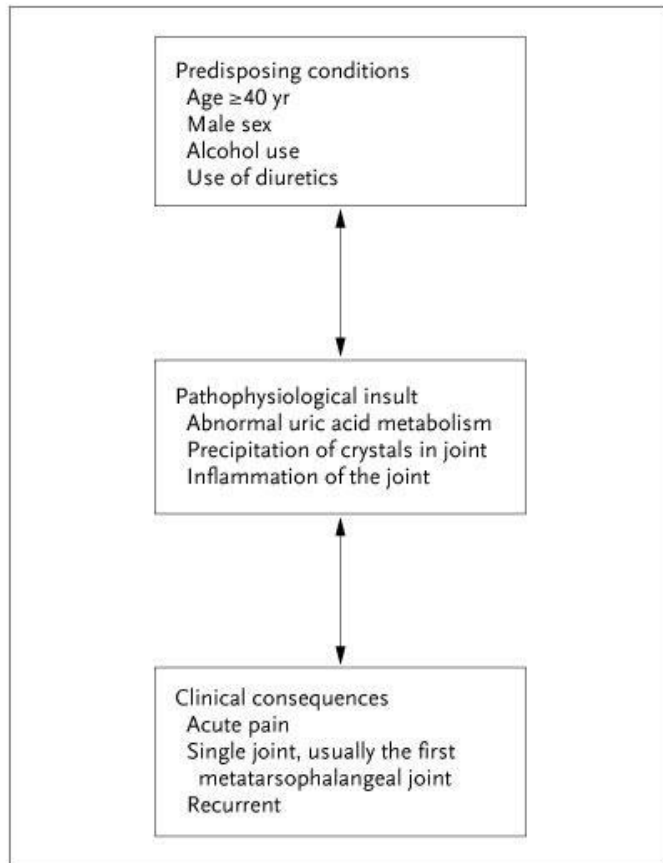
**Novice resident's response:** It could be an infection. It could be a new onset of rheumatoid arthritis. It could be Lyme disease. Since he doesn't recall falling, I doubt it's an injury. I don't know whether osteoarthritis ever presents like this, but he does have a history of knee pain.

## EXPERT — scripts compared

**Expert resident's response:** The patient has acute gout. He has had multiple discrete episodes with abrupt onset of extremely severe pain involving a single joint with evidence of inflammation on examination. Before all his episodes, he is asymptomatic. I would have expected gout to affect the first metatarsophalangeal joint, but it can present in the knee. Nothing suggests any ongoing, chronic problem in the knee. I don't see any portal of entry to suggest acute infectious arthritis and he looks quite well for that. His other joints are normal on examination. I doubt that he has a flare-up of osteoarthritis with pseudogout or a systemic, inflammatory arthritis such as rheumatoid arthritis.

**The novice lists possibilities.** The expert retrieves competing scripts, tests each against the defining features, and discards with reasons — out loud.

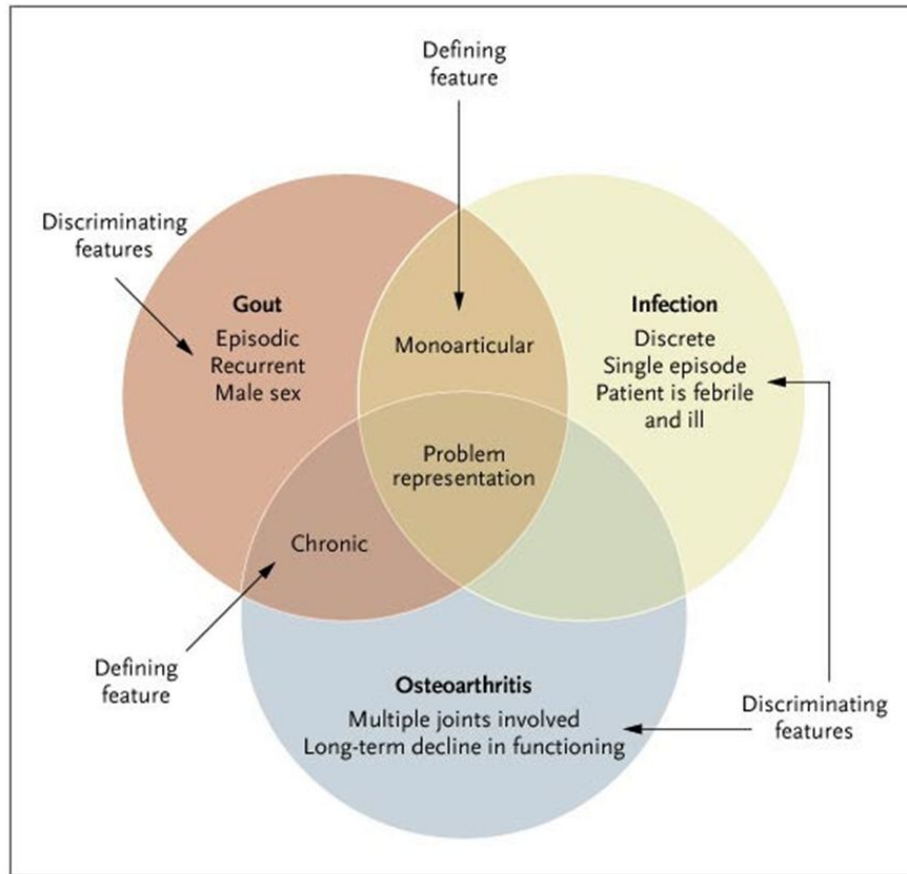
# The gout illness script



- Predisposing conditions: age  $\geq 40$ , male sex, alcohol, diuretics
- Pathophysiologic insult: abnormal urate metabolism  $\rightarrow$  crystals in joint  $\rightarrow$  inflammation
- Clinical consequences: acute pain, single joint (classically 1st MTP), recurrent
- **The expert's one-liner matched this script — that's why the diagnosis arrived instantly**



# The one-liner selects the scripts



- **Problem representation sits at the intersection of competing scripts**
- Defining features place a diagnosis in play (monoarticular → gout, infection)
- Discriminating features separate the finalists (episodic + recurrent + afebrile → gout over infection)
- Coach the one-liner, and the differential fixes itself

# 63-year-old woman with chest pain

YOUR TURN

## History of Present Illness:

63 year old female with a past medical history of hypertension, hyperlipidemia, chronic low back pain and depression presents with 2 weeks of chest pain and a few days of shortness of breath.

2 months prior to this presentation the patient experienced left sided chest pain radiating to her shoulder and back that was reproducible on exam. She was seen in the emergency department, noted to have negative troponins and a normal EKG. She was diagnosed with costochondritis and discharged home. The symptoms resolved.

2 weeks prior to this presentation the chest pain returned and was squeezing, left sided, substernal and radiated to her shoulder and back. It was made worse by exertion and improved with rest. This progressed to shortness of breath with exertion and orthopnea one day ago so she presented to the emergency department.

Past Medical History/Past Surgical History: as above

Social History: no alcohol, tobacco or drug use. Is a retired teacher

Family History: mother with hypertension and father with coronary artery disease

Medications: amlodipine 5 mg, sertraline 50mg, rosuvastatin 10mg

## Physical Exam/Data:

Vital Signs: Afebrile, pulse 95, respiratory rate 18, blood pressure 140/80, pulse oximetry 93% room air

General Appearance: Well nourished, comfortable appearing

Cardiac: Regular rate and rhythm, normal S1/S2, no murmurs, gallops or rubs. Pain was reproducible when palpating the left side of the chest, Jugular venous pressure 10 cm at 30 degrees

Pulmonary: Clear to auscultation bilaterally with no wheeze, crackles or rhonchi

Abdomen: Soft, nontender, nondistended, no hepatosplenomegaly

Extremities: No lower extremity edema

EKG: sinus tachycardia, no Q waves or ST segment changes noted

Troponin- mildly elevated

Chest X-ray: normal

All other labs within normal limits

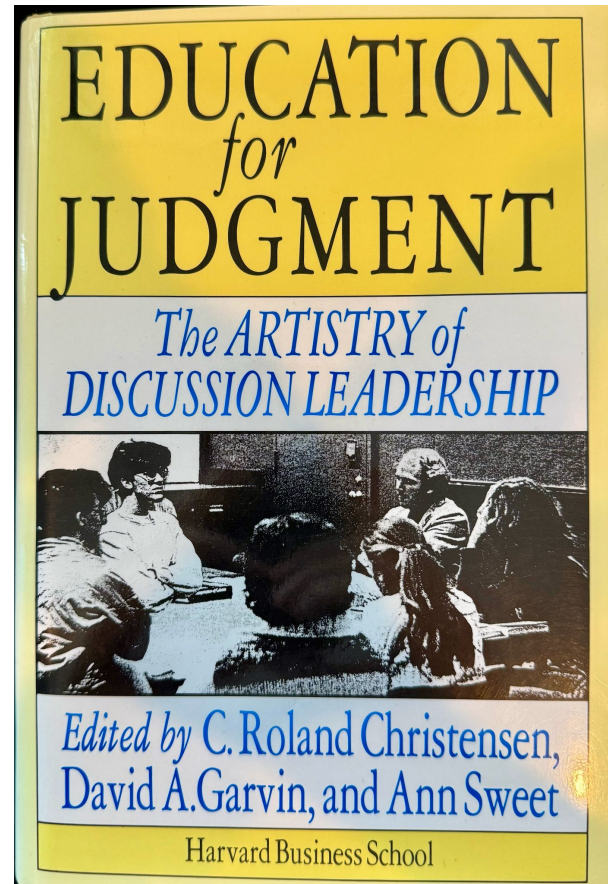
# Diagnose the learner before you teach



## What you hear tells you where it broke:

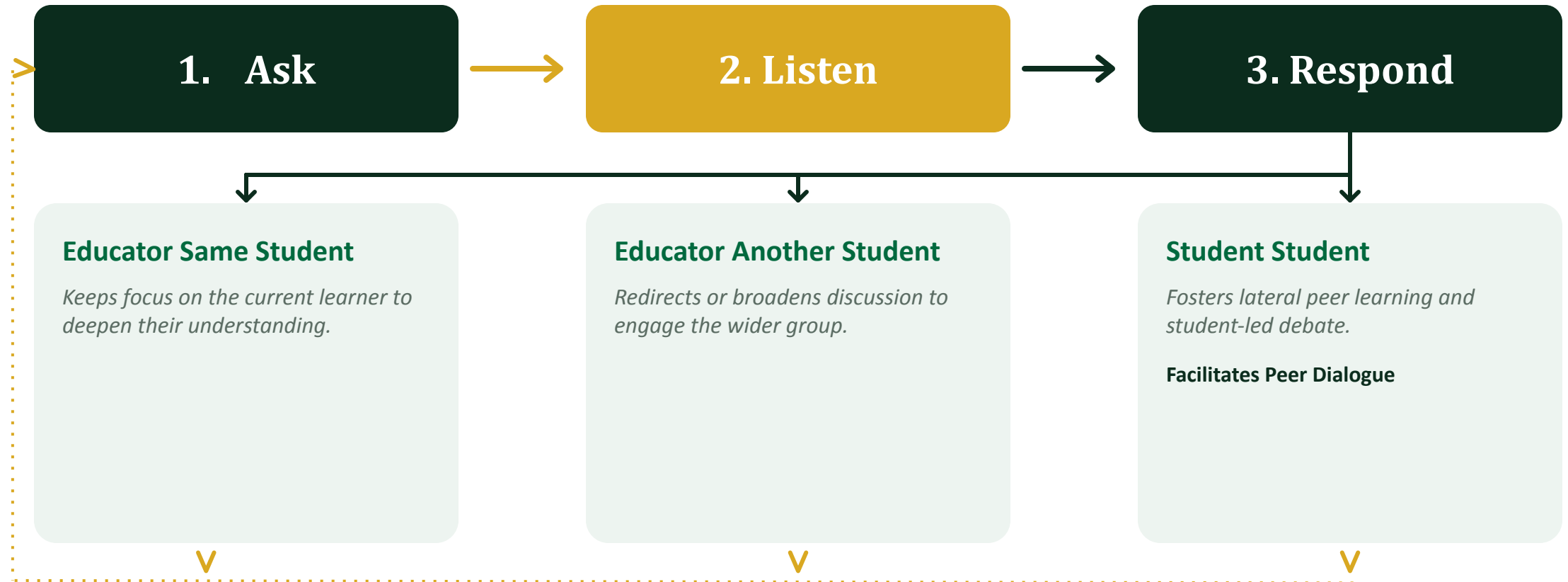
- The learner's one-liner and differential localize the deficit — knowledge, data gathering, synthesis, or prioritization (Bowen 2006)
- Different deficits need different starting points for your teaching
- That starting point is important and with varied levels of learners gives opportunities for you to progress through the learners levels too

# From theory to teaching: the art of the question



Christensen, C.R., Garvin, D.A., & Sweet, A. (Eds.). *Education for Judgment: The Artistry of Discussion Leadership*. Harvard Business School Press, 1991.

# Ask → Listen → Respond, at a glance



Source: C. Roland Christensen, "The Discussion Teacher in Action: Questioning, Listening, and Response," in *Education for Judgment* (Harvard Business School Press, 1991), ch. 9.

# Ask: question up the ladder

**Reflection** *“What did this patient teach you? How did we do?”*

*Builds metacognition*

**This patient** *“Why does THIS patient have chest pain?”*

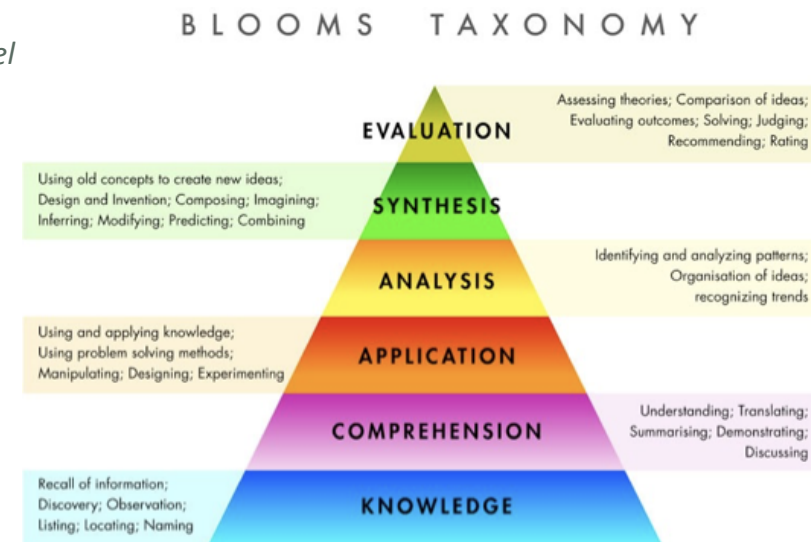
*Forces synthesis*

**Meaning** *“What does exertional chest pain make you worry about in general?”*

*Concept level*

**Facts** *“What is angina?”*

*Recall only — use sparingly*



# Ask: ten kinds of questions, not just “what’s the diagnosis”

## Open-ended

*“What do you make of this patient?”*

## Diagnostic

*“Walk me through your reasoning.”*

## Information

*“What was the troponin?”*

## Challenge

*“What’s your evidence for that?”*

## Action

*“What should we do next?”*

## Priority

*“What’s most urgent tonight?”*

## Prediction

*“What will the CTA show?”*

## Hypothetical

*“What if she were 35?”*

## Extension

*“How does that change management?”*

## Generalization

*“What rule do you take from this?”*

Gold = defer until trust is built.



# Listen on four levels. Respond with purpose.

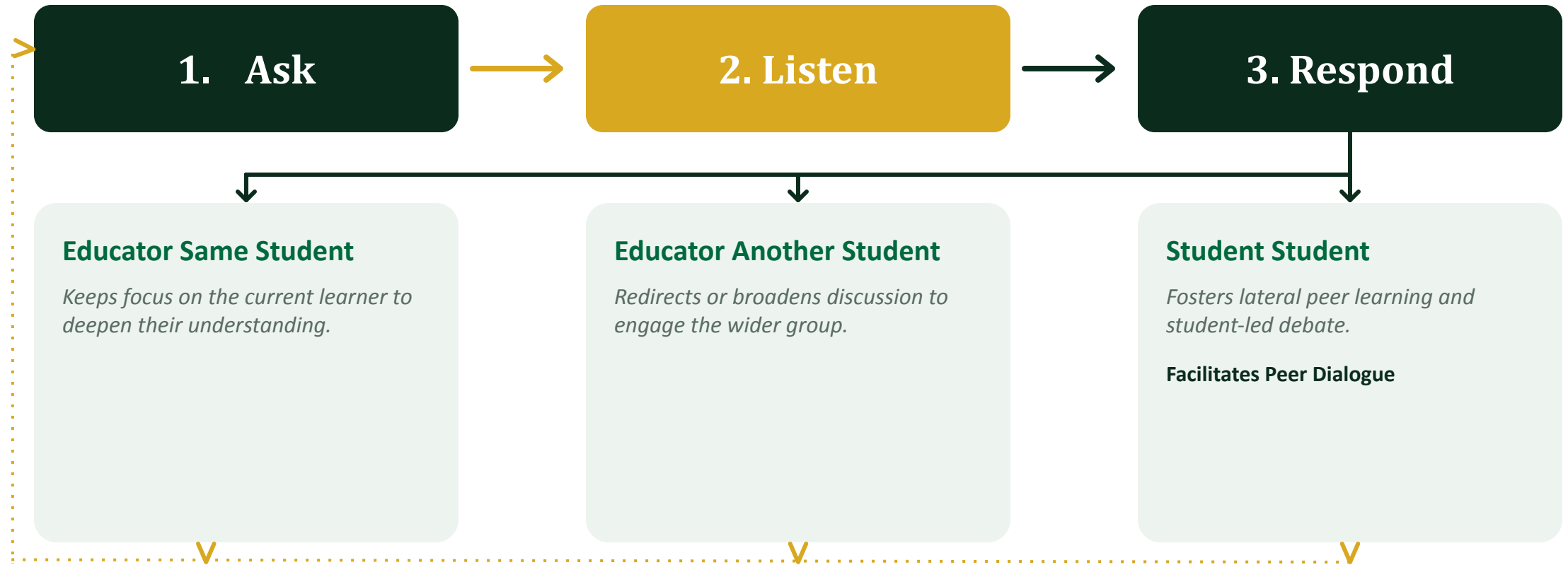
## LISTEN — ON FOUR LEVELS

- Content — does this move the teaching forward?
- Tone & emotion — tentative, forceful, flat?
- What's left unsaid — the avoided issue is data
- Disconnects — “Are you two talking about the same issue?”

## RESPOND — A DELIBERATE CHOICE

- Reinforce the point the team didn't notice was exceptional
- Protect the learner's standing in front of the team
- use silence when necessary- count to 5 before rescuing anyone

# Ask → Listen → Respond, at a glance



# When they're right, explore or extend. When they're wrong, challenge- nicely

## ✓ "IT'S GOUT" — EXPLORE

- "Why gout? What convinced you?"
- Makes them articulate the illness script: predisposing conditions, pathophysiologic insult, clinical consequences
- Maybe they know it — maybe they got lucky. You won't know unless you ask.

## ✓ "IT'S GOUT" — EXTEND

- "What if his creatinine were elevated? Does the plan change?"
- Same script, new variable: tests whether the reasoning transfers, not just the label
- If they can extend it, they own the concept. If not, you've found tomorrow's teaching point.

## ✗ "IT'S OA" — CHALLENGE

- "Why OA and not gout? Compare them for me."
- Compare-and-contrast forces script discrimination
- Think out loud if it feels unsafe to challenge them: "I worry acute + red + hot = gout" shows them YOUR problem representation. Then ask them how theirs is the same or different.

## ROLE-PLAY

# Back to our case: Coach the one-liner

## Attending led discussion with novice learner

Using ladder questions and Explore/Extend/Challenge, move the novice toward the expert one-liner — WITHOUT giving it to them.

Debrief: What was hardest? What question actually worked?

THE CASE, CONTINUED

**Admitted as new heart failure. Diuresed.**

*That night: recurrent chest pain and dyspnea.*

**CT angiography: extensive bilateral pulmonary emboli — left main and distal right main pulmonary arteries.**

*Where did the reasoning fail?*

# The biases — and the coaching moves that help catch them

| Bias                | In this case                                    | Coaching move                         |
|---------------------|-------------------------------------------------|---------------------------------------|
| Anchoring           | “Costochondritis” carried forward 2 months      | “What has changed since that label?”  |
| Framing             | Reproducible tenderness framed it benign        | “Argue the opposite case.”            |
| Diagnostic momentum | Label accepted without skepticism               | Re-derive the one-liner from raw data |
| Premature closure   | CHF accepted; hypoxemia + clear CXR unexplained | “What can't we explain?”              |
| Confirmation        | ↑JVP read as CHF; discordant data ignored       | “What argues against your diagnosis?” |
| Availability        | Common scripts recalled; PE never retrieved     | “What can't we afford to miss?”       |

# Teach error out loud

1

Run diagnostic time-outs as routine, not as rebuke

2

Practice worst-case-scenario medicine: “What can't we afford to miss?”

3

Acknowledge how the patient makes you feel — affect drives bias

4

Ask “What can't we explain?” on every complex patient

5

Admit your own mistakes; say “I don't know” in front of learners



# Teaching clinical reasoning in the age of AI

## WHAT THE STUDIES SHOW

- LLMs alone now perform strongly on diagnostic reasoning tasks (Goh 2024, JAMA Netw Open)
- Simply giving physicians the tool didn't improve their reasoning — using it well is a skill (Goh 2024; Goh 2025, Nat Med)

## WHAT IT MEANS FOR US

- **The one-liner a learner types into the AI is still a problem representation**
- Verification skills — “what can't we explain?” — now apply to the machine's differential too
- Independent reasoning becomes MORE important to teach, not less

# Take-homes

- **Your reasoning is invisible — externalize it: think aloud, refine the one-liner, compare-and-contrast scripts**
- Diagnose the learner: the one-liner and differential localize the deficit
- Ask up the ladder, listen on four levels, respond with purpose — explore when right, challenge when wrong
- Teach error out loud: time-outs, worst-case medicine, “what can't we explain?”
- In the AI era, independent reasoning matters more, not less — teach learners to verify the one-liner and the differential, whether it came from them or the machine

# Questions?

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# References

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