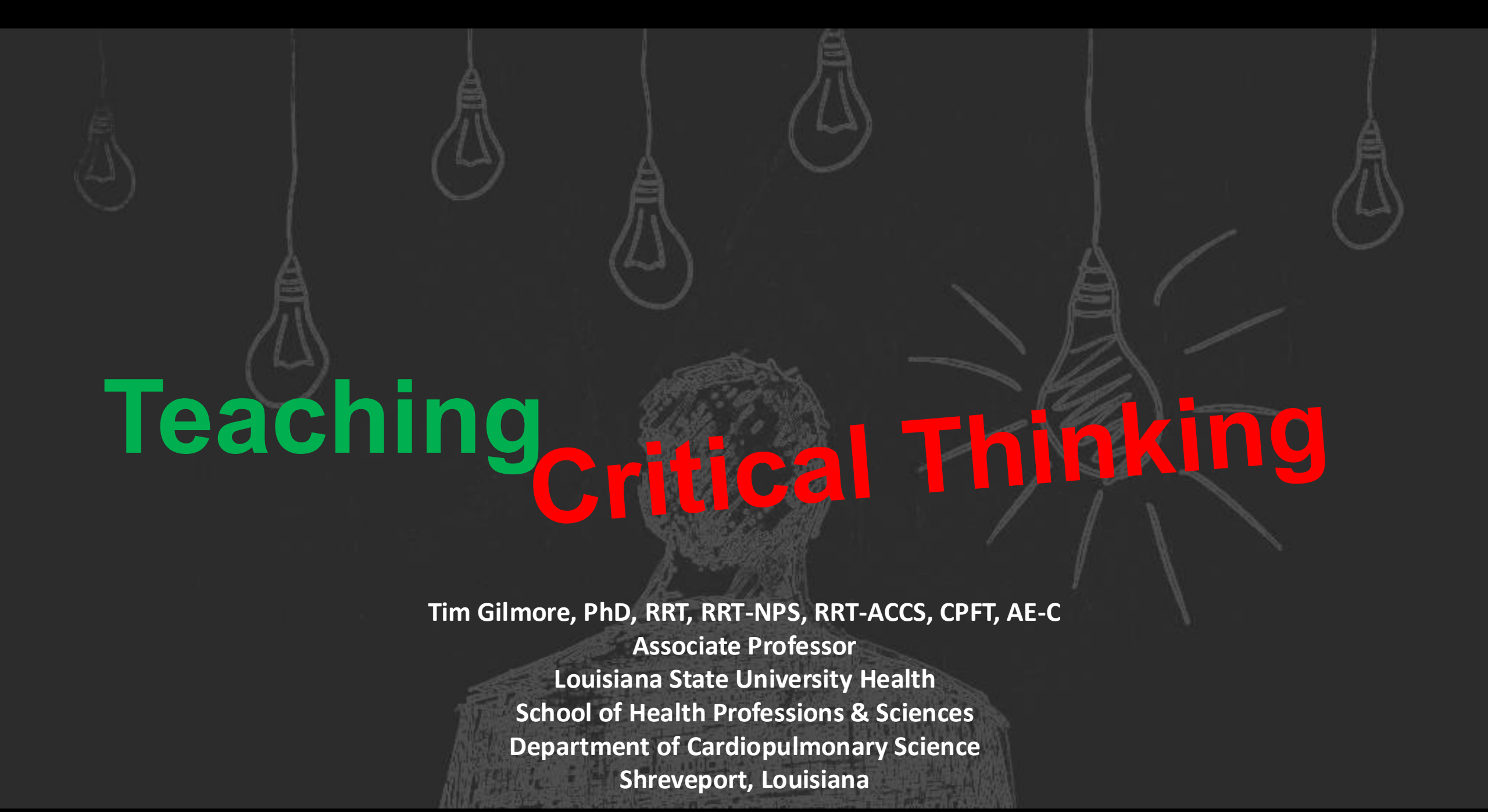


Teaching Critical Thinking

Tim Gilmore, PhD, RRT, RRT-NPS, RRT-ACCS, CPFT, AE-C
Associate Professor
Louisiana State University Health
School of Health Professions & Sciences
Department of Cardiopulmonary Science
Shreveport, Louisiana

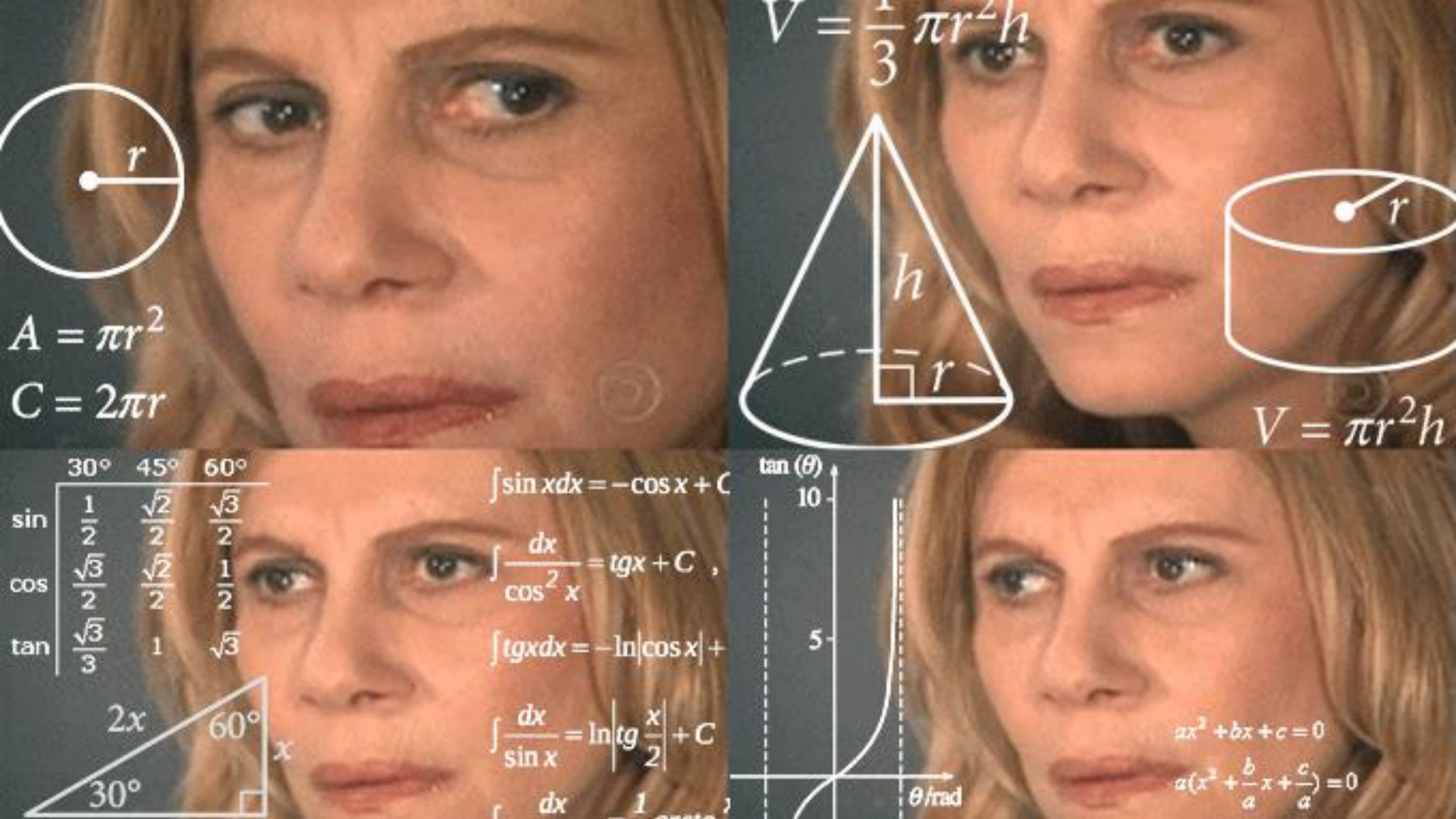
Objectives

1. Define and discuss the concept of **critical thinking** in the context of respiratory therapy practice
2. Identify **strategies to promote critical thinking** in classroom & clinical settings
    a. Explore opportunities to incorporate analytical training into curricula

Disclaimer

I am *not* necessarily an expert in critical thinking, nor do I possess any 'magic' formula to impart any analytic ability. I'm simply an educator with experience in creative approaches to encouraging various learning processes that promote the idea of critical analysis.

You are likely already teaching critical thinking to some capacity, but I hope to provide some evidence-based & practical approaches to further cultivate critical thinking among your students.


r
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$C = 2\pi r$
$V = \frac{1}{3}\pi r^2 h$
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r
r
$V = \pi r^2 h$
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cos $\frac{\sqrt{3}}{2}$ $\frac{\sqrt{2}}{2}$ $\frac{1}{2}$
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$\int tgx dx = -\ln|\cos x| +$
$\int \frac{dx}{\sin x} = \ln\left|tg\frac{x}{2}\right| + C$
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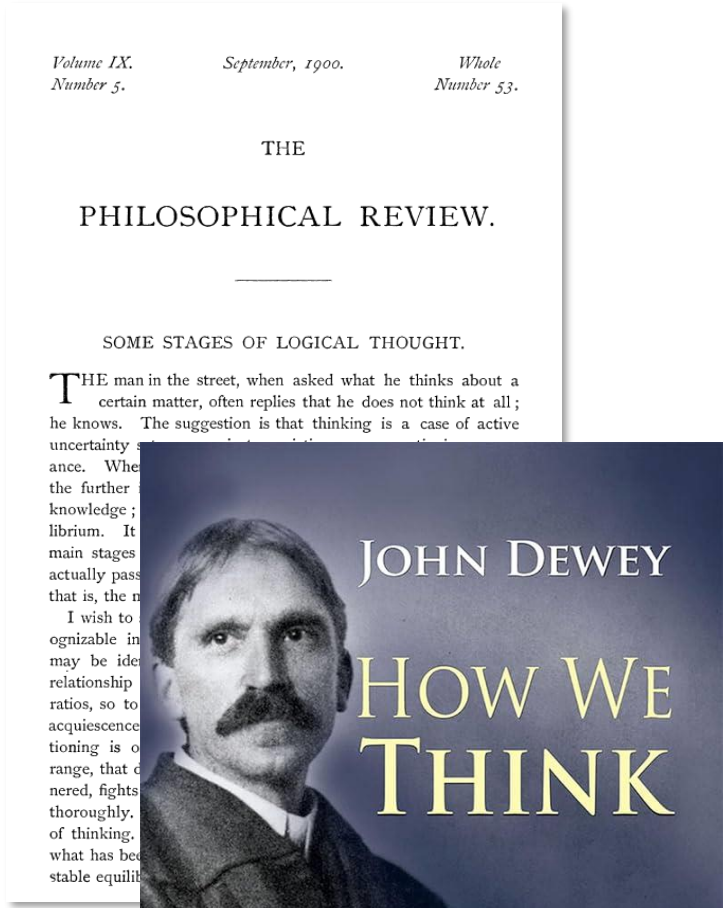
10
5
θ/rad
$ax^2 + bx + c = 0$
$a(x^2 + \frac{b}{a}x + \frac{c}{a}) = 0$

Pedagogy is the art, science, and craft of teaching, encompassing the methods, strategies, and theories educators use to facilitate learning. It involves understanding how students learn, designing instruction, and assessing outcomes, moving beyond mere lecturing to focus on creating **effective, engaging learning environments**.

AUGUSTA UNIVERSITY



Volume IX. *September, 1900.* *Whole*
Number 5. *Number 53.*

THE

PHILOSOPHICAL REVIEW.

SOME STAGES OF LOGICAL THOUGHT.

THE man in the street, when asked what he thinks about a certain matter, often replies that he does not think at all; he knows. The suggestion is that thinking is a case of active uncertainty ance. Whe the further knowledge; librium. It main stages actually pass that is, the n

I wish to ognizable in may be ide relationship ratios, so to acquiescence tioning is o range, that d nered, fights thoroughly. of thinking. what has be stable equili

"Critical Thinking"

Britannica

critical thinking, in educational theory, mode of cognition using deliberative reasoning and impartial scrutiny of information to arrive at a possible solution to a problem. From the perspective of educators, critical thinking encompasses both a set of logical skills that can be taught and a disposition toward reflective open inquiry that can be cultivated. The term *critical thinking* was coined by American philosopher and educator John Dewey in the book *How We Think* (1910) and was adopted by the progressive education movement as a core instructional goal that offered a dynamic modern alternative to traditional educational methods such as rote memorization.

What is "Critical Thinking"?

A statement by Michael Scriven & Richard Paul, presented at the 8th Annual International Conference on Critical Thinking and Education Reform, Summer 1987:

Critical thinking is the intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action. In its exemplary form, it is based on universal intellectual values that transcend subject matter divisions: clarity, accuracy, precision, consistency, relevance, sound evidence, good reasons, depth, breadth, and fairness.

Critical Thinking: A Statement of Expert Consensus for Purposes of Educational Assessment and Instruction

Executive Summary

"The Delphi Report"

By
Dr. Peter A. Facione,
Dean of the College of Arts and Sciences
Santa Clara University

CONSENSUS STATEMENT REGARDING CRITICAL THINKING AND THE IDEAL CRITICAL THINKER

We understand critical thinking to be purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, and inference, as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which that judgment is based. CT is essential as a tool of inquiry. As such, CT is a liberating force in education and a powerful resource in one's personal and civic life. While not synonymous with good thinking, CT is a pervasive and self-rectifying human phenomenon. The ideal critical thinker is habitually inquisitive, well-informed, trustful of reason, open-minded, flexible, fair-minded in evaluation, honest in facing personal biases, prudent in making judgments, willing to reconsider, clear about issues, orderly in complex matters, diligent in seeking relevant information, reasonable in the selection of criteria, focused in inquiry, and persistent in seeking results which are as precise as the subject and the circumstances of inquiry permit. Thus, educating good critical thinkers means working toward this ideal. It combines developing CT skills with nurturing those dispositions which consistently yield useful insights and which are the basis of a rational and democratic society.

Richard E. Mayer

Rote Versus Meaningful Learning[1]

LEARNING INVOLVES THE ACQUISITION of knowledge. This is a commonsense view of learning that has implications for how to teach—such as presenting information to learners in books and lectures—and how to assess—such as testing to see how much of the presented material students can remember (Mayer, 2001). The revised Taxonomy is based on a broader vision of learning that includes not only acquiring knowledge but also being able to use knowledge in a variety of new situations. When taking a knowledge acquisition view of learning, teachers sometimes emphasize one kind of cognitive processing in instruction and assessment—what we call *Remembering*. Like the original Taxonomy, however, the revised Taxonomy is based on the idea that schooling can be expanded to include a fuller range of cognitive processes. The purpose of this article is to describe this fuller range of processes in more detail.

Two of the most important educational goals are to promote *retention* and to promote *transfer* (which, when it occurs, indicates meaningful learning). *Retention* is the ability to remember material at some later time in much the same way it was presented during instruction. *Transfer* is the ability to use what was learned to solve new problems, answer new questions, or facilitate learning new subject matter (Mayer & Wittrock, 1996). In short, retention requires that students remember what they have learned, whereas transfer requires students not only to remember but also to make sense of and be able to use what they have learned (Bransford, Brown, & Cocking, 1999; Detterman & Sternberg, 1993; Haskell, 2001; Mayer, 1995; McKeough, Lupart, & Marini, 1995; Phye, 1997). Stated somewhat differently, retention focuses on the past; transfer emphasizes the future. After reading a textbook lesson on Ohm's Law, for example, a retention test might include questions asking students to write the formula for Ohm's Law. In contrast, a transfer test might include questions asking students to rearrange an electrical circuit to maximize the rate of electron flow or to use Ohm's Law to explain a complex electric circuit.

Although educational objectives for promoting retention are fairly easy to construct, educators may have more difficulty in formulating, teaching, and assessing objectives aimed at promoting transfer (Baxter, Elder, & Glaser, 1996; Mayer, 2002; Phye, 1997). The revised Taxonomy is intended to help broaden the typical set of educational objectives to include those aimed at promoting transfer.

A Tale of Three Learning Outcomes

As an introduction, consider three learning scenarios. The first exemplifies what might be called *no learning*, the second, *rote learning*, and the third, *meaningful learning*.

Richard E. Mayer is a professor of psychology and education at the University of California, Santa Barbara.

THEORY INTO PRACTICE, Volume 41, Number 4, Autumn 2002

Retention vs. Transfer

critical thinking noun

1 : the act or practice of thinking critically (as by applying reason and questioning assumptions) in order to solve problems, evaluate information, discern biases, etc.

2 : the set of skills, methods, etc. involved in critical thinking

So… We likely all have a clear picture of what critical thinking is… But, how do we teach it?

Research Articles

Do we teach critical thinking? A mixed methods study of faculty and student perceptions of teaching and learning critical thinking at three professional schools

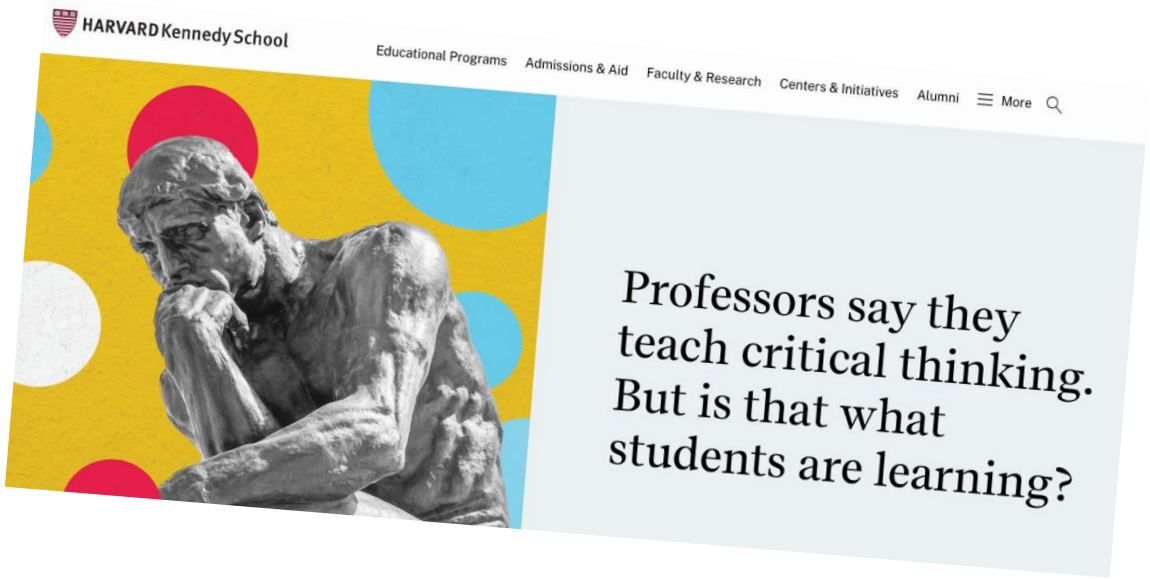
Amy M. Sullivan, Margaret M. Hayes, Christine P. Beltran, Amy P. Cohen, Morgan Soffler, Suzanne Cooper, William Wisser & Richard M. Schwartzstein ...show less

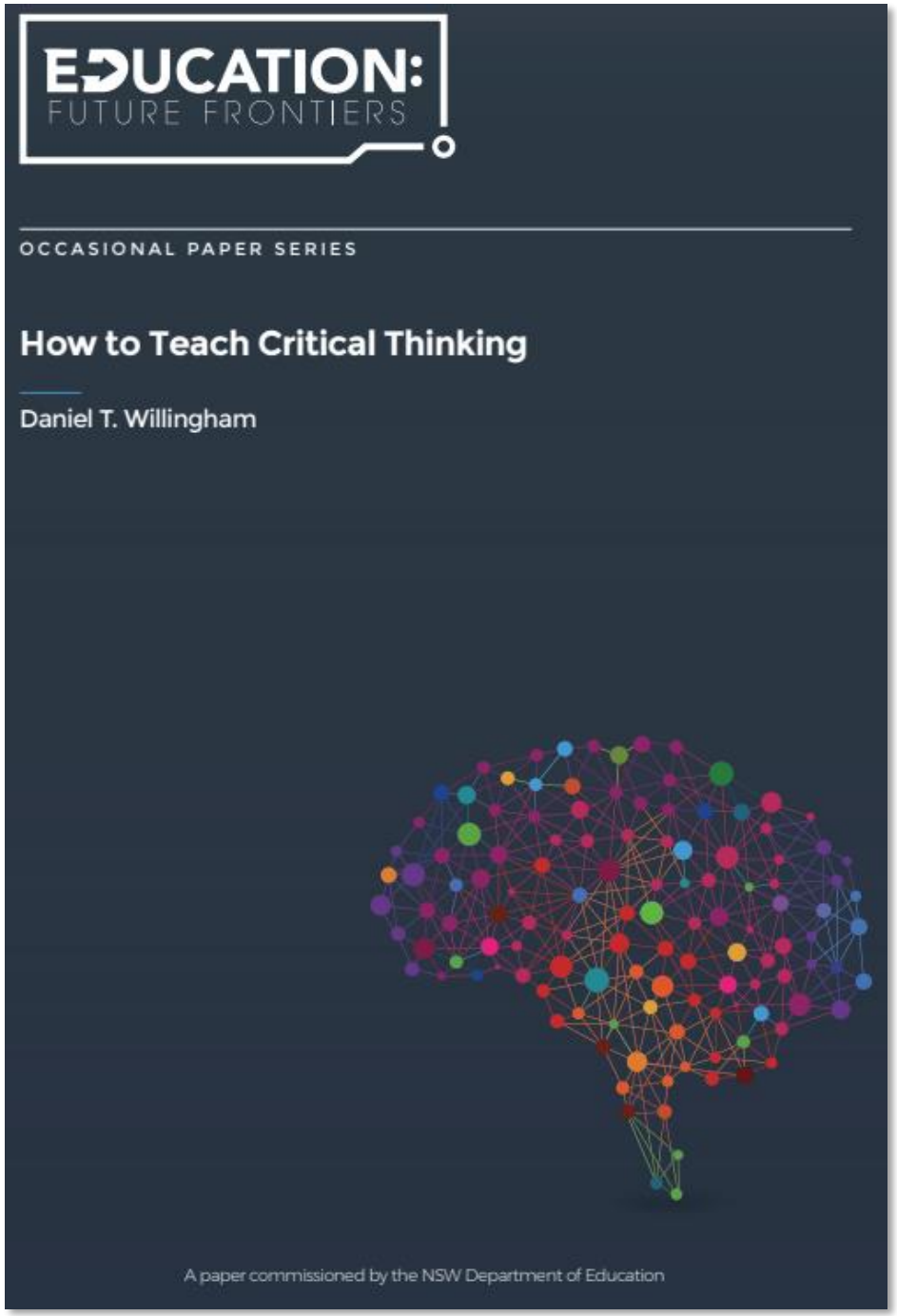
Pages 1494-1501 | Received 07 Aug 2023, Accepted 06 Feb 2024, Published online: 21 Feb 2024

What does the research say?

The researchers, including Suzanne Cooper, the Edith M. Stokey Senior Lecturer in Public Policy at HKS, compared instructors' approaches to teaching critical thinking with students' perceptions of what they were being taught. They surveyed instructors and conducted focus groups with students at three professional schools (Harvard Medical School, Harvard Kennedy School, and the Harvard Graduate School of Education).

The researchers found that more than half (54%) of faculty surveyed said they explicitly taught critical thinking in their courses (27% said they did not and 19% were unsure). When the researchers talked to students, however, the consensus was that critical thinking was primarily being taught implicitly. One student said discussions, debates, and case study analyses were viewed as opportunities "for critical thinking to emerge" but that methods and techniques were not a specific focus. The students were also generally unable to recall or define key terms, such as "metacognition" (an understanding of one's own thought process) and "cognitive biases" (systematic deviations from norms or rationality in which individuals create their own subjective reality).



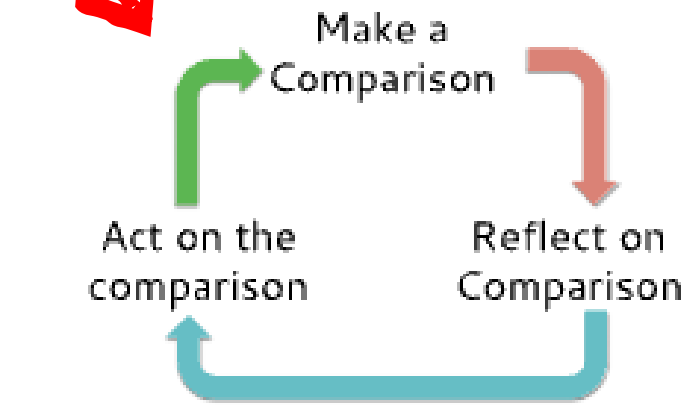


- **Critical thinking *can* be taught, but not as a generic, stand-alone skill — it must be tied to specific content.**
- **Critical thinking skills are *domain-specific*** — what counts as good reasoning in history differs from reasoning in science or mathematics.
- **Strong subject knowledge is a prerequisite** — students need foundational knowledge in a discipline before they can meaningfully analyze, evaluate, or reason about its content
- **Teaching must be explicit and systematic** — effective critical thinking instruction includes clearly identified skills, planned progression, and repeated practice, not just occasional activities or debates.
- **Transfer of skills does *not* happen automatically.** Critical thinking learned in one context (e.g., mathematics) does not reliably transfer to another (e.g., history) unless connections are deliberately taught and practiced across contexts.
- **Planning a curriculum for critical thinking requires sequencing and revisiting skills over time.**
- **Instruction that combines explicit teaching with rich content yields stronger outcomes.** Simply exposing students to challenging problems is less effective than coupling that exposure with guidance in how to reason about them.
- **Metacognitive awareness enhances critical thinking.** Students benefit when they are encouraged to reflect on their thinking processes — recognizing their reasoning steps improves flexibility and future application.
- **Problem comparison and labeling strategies help students generalize thinking structures.**
- **Critical thinking should be embedded in regular classroom practice, not relegated to extra programs.**

Teaching critical thinking

N. G. Holmes[a,1], Carl E. Wieman[a,b], and D. A. Bonn[c]

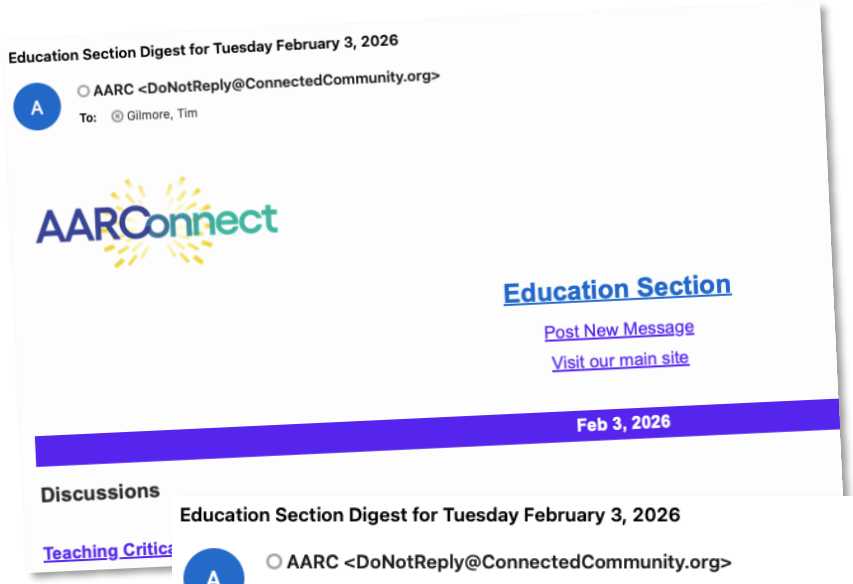
[a]Department of Physics, Stanford University, Stanford, CA 94305; [b]Graduate School of Education, Stanford University, Stanford, CA 94305; and [c]University of British Columbia, Vancouver, BC, Canada



Generalized summary equitable for clinical education (i.e., respiratory care) =

Use case studies & clinical simulations

Gather Data → Reflection → Decision


Education Section Digest for Tuesday February 3, 2026

AARC <DoNotReply@ConnectedCommunity.org>

To: Gilmore, Tim

AARConnect

Education Section

Post New Message

Visit our main site

Feb 3, 2026

Discussions

Teaching Critica

Education Section Digest for Tuesday February 3, 2026

Summarize

AARC <DoNotReply@ConnectedCommunity.org>

Yesterday at 11:18

To: Gilmore, Tim

Original Message:
Sent: 01-27-2026 11:09
From: Ellen Becker
Subject: Teaching Critical Thinking

Hi Jasmine,

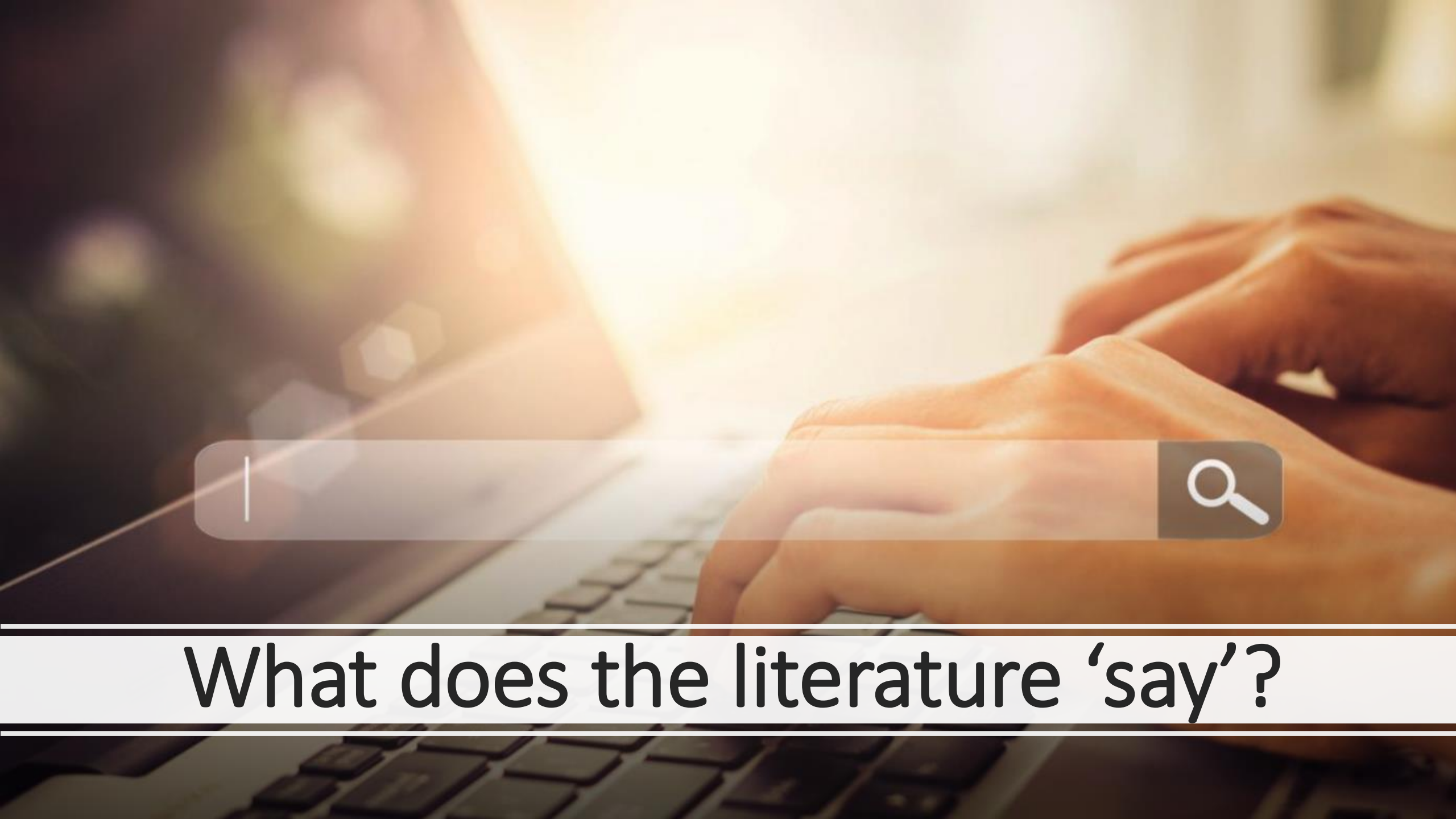
Critical thinking is often addressed as a topic and commonly mistreated as a 'global' skill. Although I have many great thinking/reasoning skills for most respiratory care topics, I lack the same expertise with automobile repairs. The takehome message here is that we need to learn different problemsolving/reasoning approaches for different types of problems. Strong educators are explicit about how to approach each general type of clinical problem. For example, the framework I used to teach PFT interpretation differed from managing neborns in transitional circulation or adults in ARDS.

If you are looking for a place to start, Mayer's work on meaningful learning recommends the following sequence for learning/thinking/reasoning:

1. Selecting information relevant to the topic
2. Organizing the information in a mental model/conceptual framework
3. Integrating the information

In my less experienced days, I was less explicit about how to work through the thinking process and spent most of my time relaying content. Erroneously, I left it up to students to figure out the thinking part (the hard part) on their own.

Ellen Becker
Chicago IL
Ellen_A_Becker@rush.edu



What does the literature ‘say’?

1. No Learning
2. Rote Learning
3. Meaningful Learning

Remember... Understand... **Apply**

Richard E. Mayer

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THEORY INTO PRACTICE, Volume 41, Number 4, Autumn 2002

Remember... Understand... **Apply**
Analyze... Evaluate... **Create**

Richard E. Mayer

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THEORY INTO PRACTICE, Volume 41, Number 4, Autumn 2002

Teaching and Learning in Medicine, 26(1), 95–102

ISSN: 1040-1334 print / 1532-8015 online
DOI: 10.1080/10401334.2013.857335

Routledge
Taylor & Francis Group

SPECIAL ARTICLE

Critical Thinking in Health Professions Education: Summary and Consensus Statements of the Millennium Conference 2011

Grace C. Huang, Lori R. Newman, and Richard M. Schwartzstein
Carl J. Shapiro Institute for Education and Research at Harvard Medical School and Beth Israel Deaconess Medical Center, Boston, Massachusetts, USA

TABLE 1
Team composition requested for institutional teams

Team Member	Example
Individual with oversight for undergraduate curriculum	Preclinical or clinical curricular dean, chair of curriculum committee
Individual within graduate medical education	Designated institutional official, dean or vice president for GME, program director of a core program
Content expert	Cognitive psychologist, educational researcher, scientist in decision making
Senior nurse educator with responsibility for curriculum at a college of nursing	Dean of nursing, program director, course director
Other	Any additional member from above

Overall Strategies

To teach critical thinking

- **Slowing down** the pace of the learning process to enable students to digest and apply knowledge
- **Actively engaging** the learner in tasks that require problems to be solved
- **Compelling students** to justify how they arrived at decisions
- **Making thinking explicit**
- **Requiring self-reflection** on the part of the learner

Teaching and Learning in Medicine, 26(1), 95–102

Other Considerations

Case-based teaching

Team-based learning

Compelling simulation exercises

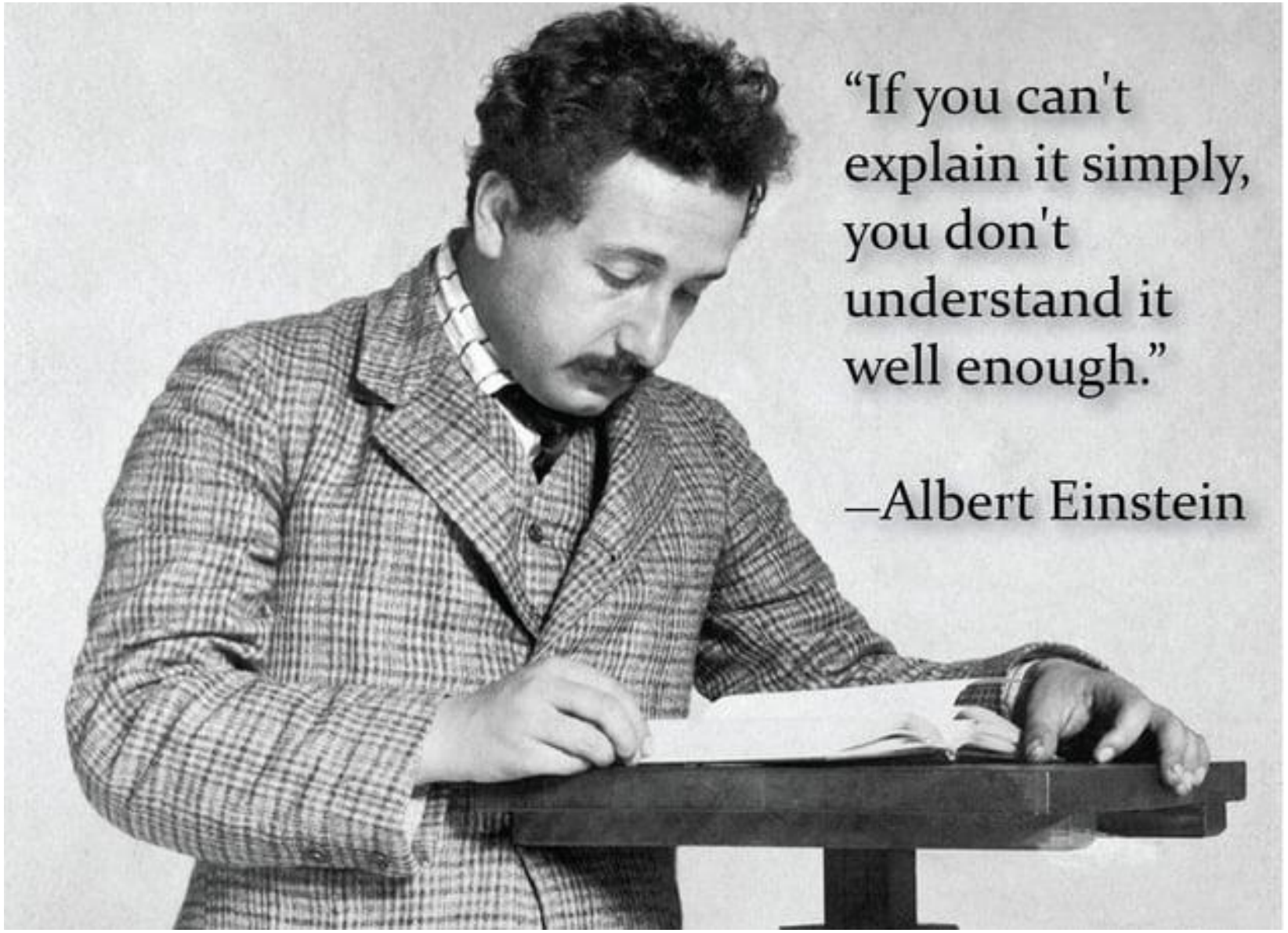
Classroom & Lab…. Yes, but What about Bedside?

Teaching and Learning in Medicine, 26(1), 95–102

TABLE 3
Potential milestones for the assessment of critical thinking

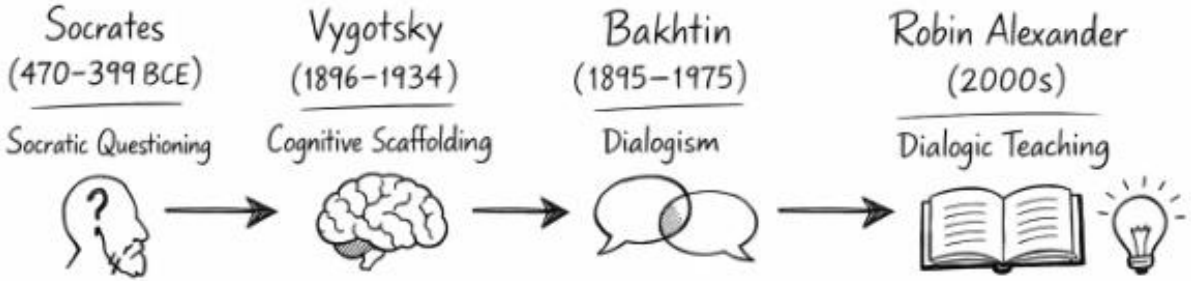
Stage	Knowledge	Skills	Attitudes
Novice	Emphasizes content over process. Lacks knowledge of critical thinking skills.	Has rudimentary ability to compare and contrast information. Is dependent on prompting from faculty. Uses memorization to solve problems.	Is not self-reflective. Believes that more facts are better. Places priority on memorization.
Intermediate	Has basic/emerging knowledge of critical thinking skills. Senses limits of knowledge.	Has emerging skills – slows down, sees limits of knowledge, asks for help. Begins to disseminate facts. Sees linkages between domains. Begins to prioritize.	Self-reflection is emerging. Recognizes need for more information. Awareness of personal role in error is evolving. Accepts second-order decision making.
Master	Modulates content, process and context well. Has intricate knowledge of critical thinking skills. Knows the critical thinking skills related to error.	Flexibly integrates and applies critical thinking to patient care. Uses adaptive expertise (toggles between Systems 1 and 2). Uses metacognition routinely. Is able to teach and articulate own thinking process.	Considers arguments on both sides as well as "gray areas." Appreciates need to develop critical thinking skill to improve patient outcomes. Embodies intellectual humility. Accepts uncertainty. Sees self as a lifelong learner.

Teaching and Learning in Medicine, 26(1), 95–102


“If you can't explain it simply, you don't understand it well enough.”
–Albert Einstein

How Do We Encourage/Teach
Critical Thinking?

Dialogical reasoning



Dialogic vs. Traditional Teaching

Shifting classroom talk for deeper learning

Traditional Teaching

1. **Teacher-led Instruction**
   One-way transmission of fixed knowledge
2. **Fixed Answers**
   Focus on recalling correct information
3. **Passive Listening**
   Limited student voice or participation

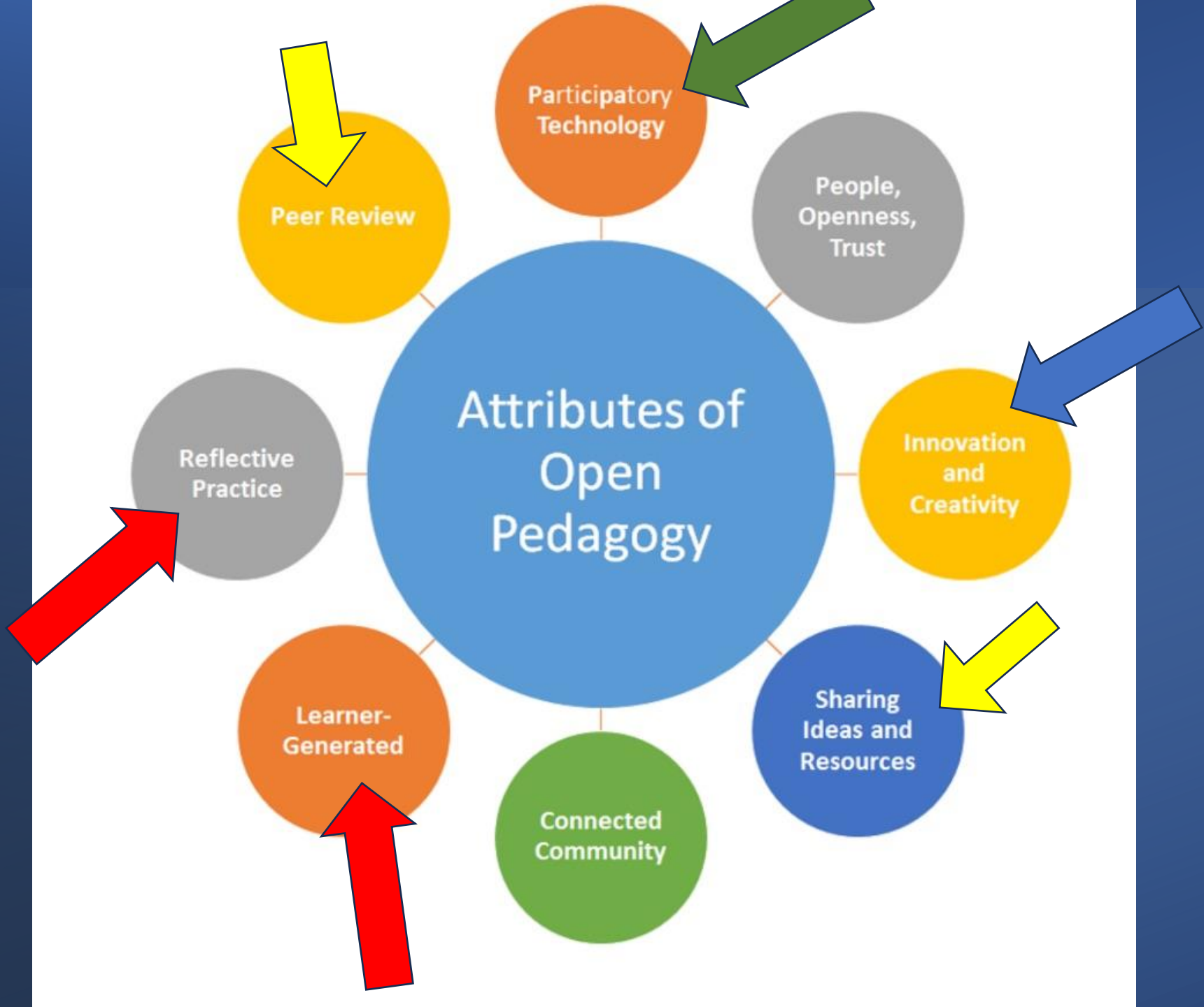
VS

Dialogic Teaching

1. **Collaborative Dialogue**
   Students build ideas, think aloud together
2. **Open-ended Inquiry**
   Elicit new thinking through questioning
5. **Active Participation**
   Every voice contributes to collective learning

Structural Learning

Structural Learning


Attributes of Open Pedagogy
Participatory Technology
People, Openness, Trust
Innovation and Creativity
Sharing Ideas and Resources
Connected Community
Learner-Generated
Reflective Practice
Peer Review

Pertinent Items of Interest

- Practice doesn't make perfect, …**practice makes practicing seem less like practice** and more like second nature.
- Critical thinking can be encouraged, practiced, and honed, but **critical thinking may not be a general, easily transferable skill** that can be taught in isolation
- Critical thinking:
  - Requires novel, self-directed, & effective thinking
  - Can be improved – Instruction is most effective when teachers:
    - Provide rich context knowledge in a discipline
    - Give students extensive practice applying thinking within that domain
    - Offer explicit guidance & feedback on how to evaluate evidence, reason, & solve problems

Ask the Cognitive Scientist: How Can Educators Teach Critical Thinking?

By Daniel T. Willingham

aft Education Healthcare Public Services

Key Concepts

- Establishment of **collaborative learning environments** that expose students to different viewpoints & reasoning strategies fosters critical thinking
- **Inquiry-based learning** must be the norm – encourage students to ask questions, explore, & engage subjects more deeply
  - Create purposeful conundrum
  - Inspire students to seek answers & form their own understanding
- **Metacognition** must be considered
  - Thinking about one's own thinking helps identify biases & gaps in knowledge

Source: Richardson, 2023. *Medium*

Case Example

Oxygenation vs. Ventilation

- SpO2 vs. ETCO2
- PaO2 vs. PaCO2

Simple Case:

A 19-year-old college student presents to urgent care with fever, cough, dyspnea, and fatigue x 3 days

Current vital signs: RR: 32bpm, HR: 118bpm, BP: 112/70, Temp: 38.8°C, SpO_2: 88% on room air

Lung sounds: Crackles in right lower lobe

Case Example

68-year-old male smoker with history of CHF presents to the ED with: history of severe COPD with home O2 2L/min, Increasing dyspnea x 3 days with productive cough

Vital Signs:

RR: 34 bpm, HR: 122 bpm, BP: 168/92, SpO_2: 81% on 2 LNC, Temp: 38.1°C. Accessory muscle use noted with diminished breath sounds with prolonged, expiratory wheezing

-
- Initial ABG
- pH: 7.29
- $PaCO_2$: 68 mmHg
- PaO_2: 54 mmHg
- HCO_3^-: 31 mmHg
- CXR reveals: Hyperinflation, hazy bilateral lower lobes

Example

‘Inservice’ on Ventilator Waveforms & Asynchrony

Ideal Structure for Experienced Clinicians

1. Present the patient

Keep it realistic.

2. Give incomplete information

Force interpretation.

3. Let them commit to a decision

Polling works extremely well.

4. Change the patient condition

Now they must reassess.

5. Reveal device mechanics/limitations

Tie physiology to the technology.

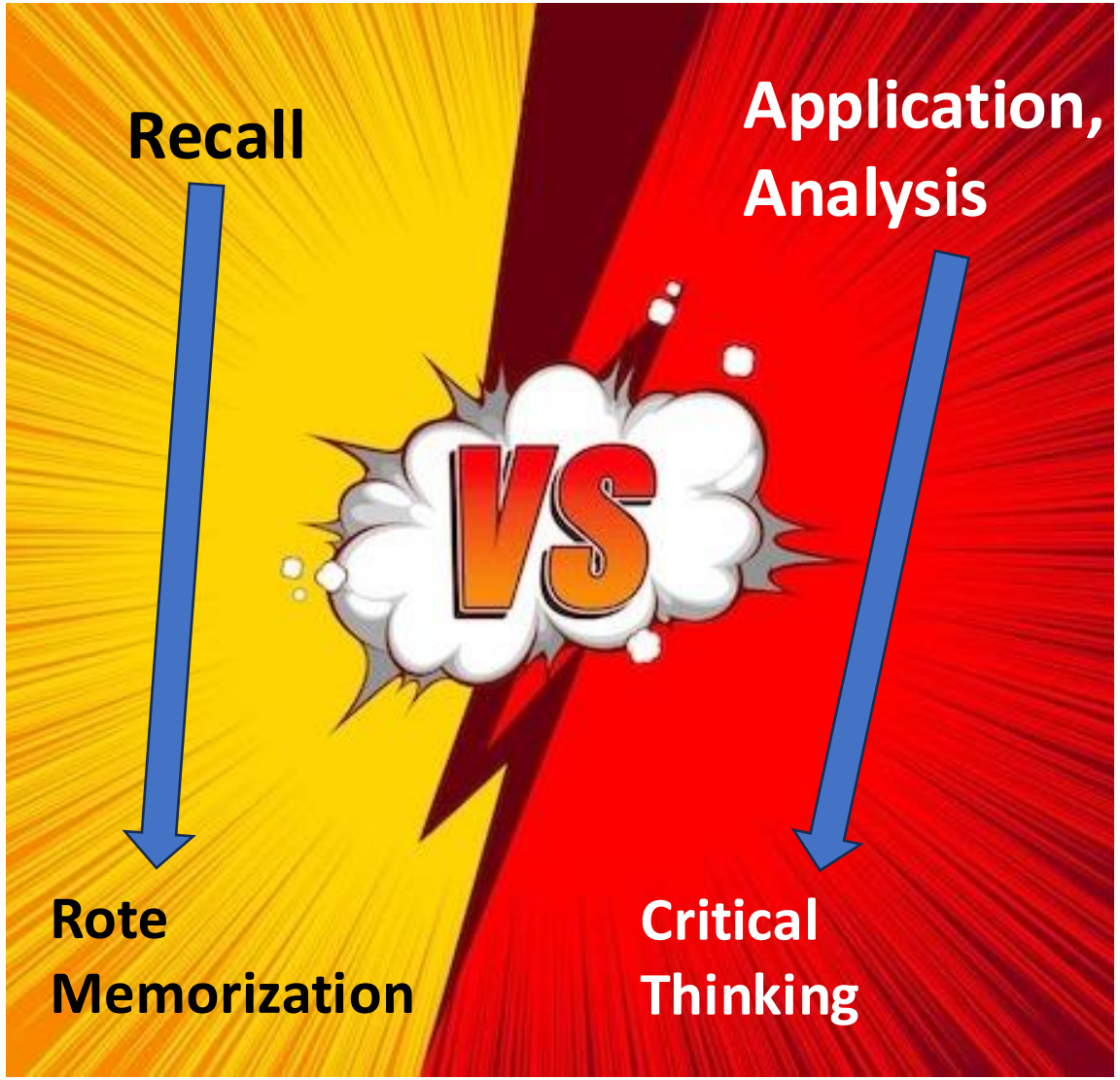
6. Debrief cognitive errors

This is where learning solidifies.

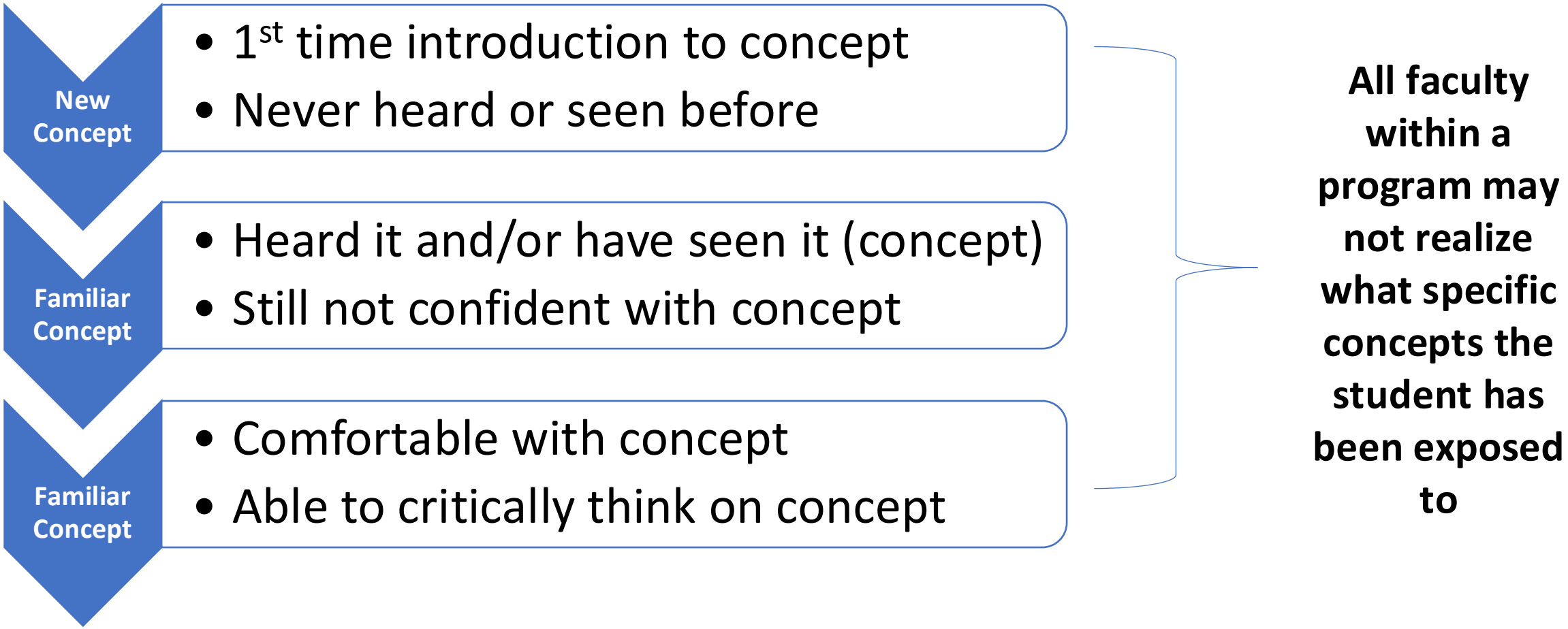
Another Practice Example

Concept:

Mucociliary Escalator



Typical Clinical Teaching Breakdown



Key Take Aways… Perspective

- Critical thinking:

  1) Goes **beyond memorization**; It's the application of knowledge

  2) Must be **taught within** the **context** of the discipline

  3) Requires **strong foundational knowledge before meaningful analysis** can occur

Key Take Aways… What Works?

1) **Case-based learning & simulations** are among most effective strategies to teach critical thinking

2) The best teaching environments **encourage dialogue, questioning**, & justification of decisions

3) Critical thinking develops through **guided practice**, feedback, & reflection over time

4) Experienced clinicians benefit most from **incomplete, evolving clinical scenarios**

5) The educator's role is to **facilitate thinking**, not simply deliver the information

Critical thinking is not a single skill that can be “taught once,” but rather an ongoing process of guided reasoning, clinical interpretation, physiologic understanding, and reflective practice that **must be continuously cultivated** in both classroom and bedside environments.

Questions?

Thank you for listening

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