Teaching critical thinking in the undergraduate medical curriculum

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Teaching Critical Thinking (TCT) in a nutshell
not teaching what to know – Learning How to Think

• Teaching → Learning (Learning-centered)
• What → How (Skill-centered)
• Knowledge → Understanding (Scholarly community-centered)

“Any fool can know. The point is to understand.” Albert Einstein

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ACKNOWLEDGEMENTS

The Charge and Learning Objectives*
Teach critical thinking and the generation of medical knowledge as a bridge to the Scholarly Project

*Deans Art Levine MD and Steve Kanter MD

“Journal Club” 42 ... 64 with Mary Choi MD, Amy Justice MD PhD 2001-2004
Methods and Logic in Medicine (MLM) with Beth Piraino MD 2005-2008
Methods and Logic in Medicine (MLM) with Rachel Givelber MD 2009-present
Lab of Educational Technology with JB McGee MD, Peter Kant Med 2004-present
Scholarly Project with Mike Boninger MD, Allen Humphrey PhD 2005-present

“We teach as we are taught.” Neal Whitman

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Where we are going this afternoon

1. Concepts from cognitive science
2. Developing a learning cycle
3. Key approaches learned in MLM I and II
Three take-home concepts from cognitive science

• Critical thinking engages a set of higher order thinking skills

• By its very name, critical thinking is thinking as a critic things – staking a claim and evaluating it pro or con by reasoning from the evidence

• Teaching critical thinking must go beyond evaluative thinking – by combining it with creating thinking to engage the scholarly community

You cannot solve a problem from the same consciousness that created it. You must learn to see the world anew.” A.E.
Critical thinking is higher order thinking
Benjamin Bloom’s hierarchy of cognitive skills

- TCT focuses on “HOTS”
- TCT assumes and scaffolds “LOTS”
- Teach evaluating & creating thinking, but how?

“Teach HOTS and assume LOTS”
- our 1st motto

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Critical thinking is unnatural

• About as 180° from common sense as you can get
• Part of the problem is common sense is error prone – works OK for pedestrians
• For evaluative scientific thinking in medicine cognitive errors derail efforts
  (formal logic is like statistics – must be taught in context)
• Concept is already established in medicine in quality control and patient safety
• It’s not formulaic, either then it’s not critical thinking!
Creating thinking is a centerpiece of Critical thinking

• Creating thinking is implicit reasoning – pre-reasoning

• A patterned way of thinking designed to explain, predict, and build concepts and things in a better and more productive way

• Brenner and Crick’s shared office rule for creating thinking: “Speak aloud whatever’s on you mind that is potentially new and important” and to the blackboard the two would go, day after day for two decades.

“A really good question is half the answer.”
via Chris Goff, Brenner and Crick, Nobels in Physiology or Medicine
Answering the charge – Interval training by alternating creating and evaluating thinking

• Critically thinking scientists and physicians do this throughout their careers, alternating the implicit reasoning to come up with good questions – hypothesis generation, with the explicit reasoning with colleagues, the literature, and their own results.

• First year medical students in his or her own mind could practice creating thinking by generating good medical hypotheses and investigate them in the medical literature database (computerization).

• The medical students in small active learning sessions could practice evaluating thinking by assessing the scientific validity of a clinical paper and its relevance to a patient or patient group of interest.

“Hypothesis generation & Investigation, Evaluation & Communication” – our 2nd motto
The “Medical Cycle” as the learning cycle for Methods and Logic and Medicine I and II

“The medical cycle – you begin by defining the patient’s problem, investigate it in the medical literature, then bring the relevant knowledge back to your treatment plan for the patient. We’re teaching the students to develop this cycle throughout their lives as physicians.”

Staging the Medical Cycle deliberate practice intervals in the Journal Club and MLM courses

Creating thinking activity: medical hypothesis generation

Experiment/Trial/Literature Observations

Design to test new and important* claim about world

Creating Thinking activity: investigate database, models, patients

Conclusion, Limitations*, For Patient/Model

Evaluating thinking activity: explanatory reasoning

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e.g., Effects of 2nd Hand Smoke
Lessons from Methods and Logic in Medicine on teaching critical thinking

• Two Mentors, Matching, Roles, Modeling, Swapping – 6 mentors by completion

• Authenticity in Medical Profession
  – Student Roles as Investigator – Teaching of students and mentors
  – Student Role as Peer Reviewer – Evaluating Investigator and auto-engaged

• Faculty to Faculty bantering – how the medical community behaves and interacts

“To teach is to learn twice.” Joseph Joubert
-works for thinking skills as well as content!
Do’s and Don’ts for Mentors TCT

Do show respect as you would to a peer by always assuming no difference between your student critically thinking through established knowledge for the first time, and a card carrying member of the medical community discovering new medical knowledge.

Cognitively the processes are nearly identical and student will get that card on graduation!

Don’t lecture!

Do not lecture!

Do not lecture ever!
Instructional scaffolding is crucial to TCT

- via PBL’s, Pre-researched **case scenarios** dove-tail with and expand on what the medical students are learning in their concurrent rote-knowledge courses

- **PICO** introductory slides and **logic mapping** concluding slides to guide each of my student Investigators

- Four Peer Reviewers independently evaluate article to be presented by an Investigator, submit **one page reasoned critique due evening before** the small group session. It engages the students not presenting/teaching the article to the class making them highly knowledgeable for participation in the active learning.

Rachel Givelber is a master scaffolder in scientific reasoning in medicine – okay my last plug!
Lessons on orchestrating the small group session

- Plan before and use Reviewers one-pager critiques to orchestrate the discussion over differing points of views or emphasis across the Investigator and Reviewers.

- At the very first session with a new small group identify the students who are passive, use their critiques to engage them in the discussions right from the start.

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The “How-do-you-know?” mentor – How & why questions and developing trust so you can ask them

• Main tool – How and why questions, model generative questions, which require the learner to explain and reason support for their claims. Like lecturing – lose the who, what, when, and where, questions!

• Structured querying creates and evaluates concept metrics: Student 30% - Scholar 90% - **150%**. Also transfers the ownership of learning these skills to that student.

• Demonstrating keen interest in the learner’s deliberate practice for improvement and earn trust, then this happens:
  “... asks really tough questions” ... yet 4.5-4.9 evaluations year after year

“Questions that structure the learner to reason correctly”
-our 3rd motto
Limitations in Methods and Logic in Medicine

• Mentoring mentors – basically we select out the a priori great performers ... time to more deliberately and purposely share our approaches, including this Powerpoint, to small group active learning environments

• The virtual tutoring and small group rooms – knowledge flows did not happen the way Peter Kant and I had planned, we gave up ... time to try again?

• No outcomes research on impact of MLM ... time to administer a before and after questionnaire, periodically, and through the completion of the Scholarly Project....
Q & A

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Take-Home Messages from MLM Courses

• Teach learning how to think rather than teaching what to know

• Scaffold to get student to stake a claim of medicine and support it by reasoning from the evidence pro and con – logic mapping

• Be a “How-do-you-know?” mentor by only asking questions that force the student to reason correctly – no lecturing!

• Engage the student in deliberate practice of Creating and Evaluating Medical Knowledge along The Medical Cycle as a bridge to the Scholarly Medical Community

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