WAYNE STATE School of Medicine | Department of Biochemistry, Microbiology and Immunology

BMI Teaching Trends Newsletter – August 2021

Teaching Matters
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Teaching Critical Thinking (part 2)

Last month's newsletter cited the Inside Higher Education article by Jonathan Haber, *It's Time to Get Serious About Teaching Critical Thinking*, which resonated with several of our faculty. The author of this publication has been invited to present a special seminar via Zoom to the BMI Department on September 17, 2021 at noon.

The article contrasts two forms of logic, deductive and inductive, as part of the discussion of critical thinking practice. Critical thinking must be based on a structured process which should be taught to students. Inductive reasoning begins with a premise that supports a conclusion making the conclusion part of reasoning that inductive reasoning is trying to prove. Inductive reasoning is also referred to as "cause and effect reasoning" or "bottom-up reasoning" because it seeks to prove a conclusion first. Contrast this with deductive reasoning in which a premise develops a true and valid conclusion. With deductive reasoning, the conclusion must be true if the premises are also true. Deductive reasoning (top-down reasoning) uses general principles to create a specific conclusion. For students to develop as critical thinkers, they must be aware of the distinction when reading research literature or designing their own experiments. They must put their foundational knowledge to work through deliberate practice that specifically focuses on development of critical-thinking skills. Deliberate practice is accomplished through assignments that opportunities to practice applying critical-thinking principles to answer questions and solve problems specific to academic content areas

Tim Van Gelder from the University of Melbourne published a report Teaching Critical Thinking: Some Lessons from Cognitive Science which provided six key lessons to help us understand how to facilitate critical thinking skills in our students:

Lesson 1, The development of critical thinking skills is difficult

Humans are not naturally critical and cognitive science refers to the develop of critical thinking as a higher-order skill. Humans are by nature, pattern-seeking story-tellers that prefer familiar patterns and narratives with desired outcomes that are affected by personal bias.

Lesson 2, Practice Makes Perfect

The development of any skill, e.g., athletics and music, requires deliberate practice.

Deliberate practice as defined in a reference by Ericsson, et al. can be summarized by the following four points:

1. It is done with full concentration and is aimed at generating improvement.
2. It is not only engaging in the skill itself but also doing special exercises designed to improve performance in the skill.
3. It is graduated, in the sense that practiced activities gradually become harder, and easier activities are mastered through repetition before harder ones are practiced.
4. There is close guidance and timely, accurate feedback on performance.

Lesson 3, Practice for Transfer

A transfer of acquired knowledge and skills certainly does occur to some extent; otherwise, education would be an exceedingly laborious. The argument for K-12 and undergraduate institutions is that teachers and faculty should utilize opportunities within their subject to practice critical thinking and encourage application across coursework.

Lesson 4, Practical Theory

Some degree of acquiring the principles of the theory are required which like any field of science necessitates acquiring a new vocabulary. For example, rather than the learner saying, "That argument sucks," the critical thinker would say that they do not accept the conclusion, even though they grant the premises. They would base their conclusion that the argument is an example of inference and based on the fallacy of post hoc ergo propter hoc.

Lesson 5: Map it Out

Critical thinking practice is a process of dissecting arguments. As with any problem in logic, if the evidence forms complex hierarchical structures, then those structures can be diagrammed or mapped out to make the logical structure of the argument completely explicit.

Lesson 6: Belief Preservation

A critical thinker needs to be aware of, and avoid cognitive biases. The human mind has intrinsic tendencies toward biases and hardwired biases exist from evolution and societal influence. The ideal critical thinker avoids the need for belief preservation and puts effort into finding evidence that contradicts their current beliefs.

In conclusion, the principals of deliberate practice can be applied to critical thinking as a skill with multiple opportunities to practice throughout a learner's academic career. For graduate students, there is the opportunity for early introduction and reinforcement in departmental coursework, journal clubs, internal and external research presentations. Biases in science are evident with inductive vs. deductive reasoning that students may not be aware of and examples of poorly executed research are effective teaching tools. It may be possible to design exercises for students dissecting and discussing research papers as critical thinking practice. Research reports that are considered seminal in a field as well as those revealed to have flawed logic can be used as teaching tools.