

## Annotated Bibliography

### Fostering Critical Thinking Skills

Richard M. Schwartzstein, M.D.

**Guerrero, APS, Mechanistic case diagramming: A tool for problem-based learning. Acad Med. 2001;76:385-389.**

Dr. Guerrero describes a detailed approach to mechanistic thinking that specifically addresses problem-based learning in pathophysiology courses in medical school. However, the basic concepts described in this paper are applicable to teaching critical thinking at all levels.

**Bowen JL, Educational strategies to promote clinical diagnostic reasoning. New Engl J Med. 2006;355:2217-2225.**

This well documented article details many of the prevalent notions about how doctors reason in the clinical setting when formulating differential diagnoses. It focuses on “problem representations,” which are a modified form of pattern recognition, and hypothesis generation. The paper contains an interesting table that outlines strategies for analyzing problems that a student or resident might have in the assessment of a patient, and ideas for how a teacher might assist the learner in addressing these problems.

**Torre DM, Daley BJ, Sebastian JL, Elnicki DM. Overview of learning theories for medical educators. Am J Med. 2006,119:903-907.**

This paper offers a brief, but nicely detailed, overview of learning theories that frames much of the discussion about critical thinking. The authors delineate the cognitivist orientation and the factors that contribute to critical thinking skills.

**Norman G. Research in clinical reasoning: Past history and current trends. Med Ed. 2005;39:418-427.**

Norman offers an overview of the evolution of cognitive theories over the past 30 years and their impact on how we view critical thinking and clinical reasoning.

**Auclair F. Problem formulation by medical students: An observational study. BMC Medical Education. 2007;7:16.**

This paper outlines an interesting research study that examined how students tried to solve a CPC case from the New England Journal of Medicine. Students who were able to employ “higher order concepts” were able to construct a more robust differential diagnosis and were more likely to arrive at the correct diagnosis.

**Croskerry P. The importance of cognitive errors in diagnosis and strategies to minimize them. Acad Med. 2003;78:775-780.**

This paper, written by an emergency medicine faculty member at Dartmouth Medical School who has studied errors in clinical reasoning for a number of years, describes a number of classical thinking errors made by physicians when making decisions about patient care. In particular, he details errors characterized as “cognitive dispositions to respond.”

**Bordage G. Did I miss the diagnosis? Cognitive explanations and educational implications. Acad Med.1999;74:S138-S143.**

The author delineates errors in thinking and links them to cognitive theories.

**Mylopoulos M, Regehr G. Cognitive metaphors of expertise and knowledge: Prospects and limitations for medical education. Med Educ. 2007; 41:1159-1165.**

The authors put forward an interesting discussion about expertise, making the distinction between routine experts and adaptive experts.

**Schmidt HG, Remy M, Rikers JP. How expertise develops in medicine: Knowledge encapsulation and illness script formation. Med Educ. 2007; 41:1133-1139.**

This article is a review of the cognitive theory underlying the principle of encapsulation of knowledge and its application to clinical reasoning. Specific attention is given to “illness scripts” in medicine.