

Approach	Summary	Flexibility	Thinking skills	Teaching caveats	Uses	MB's examples
Case Studies (single, continuous, or sequential-interactive cases)	Real world problems are presented in the class materials. No "fieldwork" or additional research required	No single solution, no specified algorithm	Critical thinking, induction, deduction, synthesis, etc.	Careful set up, good debriefing	Homework, take home exams, paper topics, individual or teams, lab work, discussion starters	Introductory Anatomy and Physiology "at the clinic" problems on take-home exams
Problem-Based Learning	Similar to the case method but students conduct outside research to find information	No single solution, no specified algorithm	Critical thinking, induction, deduction, synthesis, information gathering, teamwork, etc.	Careful development of rubric for grading	Homework, paper topics, individual or teams, usually works best with teams	Environmental Biology mock Environmental Impact Report
Quantitative Reasoning Problems	Context rich information is presented based on a realistic quantitative problem in the discipline	May have a single "answer", set of possible algorithms specified	Critical thinking, identification of variables, selection of an algorithm, numerical skills, etc.	Modeling of how to approach problem type, prevent plug-and-chug approach	Homework, class work, individual or teams, discussion starters	Biology majors population biology data analyses
Laboratory Work Using Scientific Method (including POGIL)	Realistic problem that requires hands-on lab or fieldwork including the design of procedures.	Scientific method specified, application has many possible variations	Critical thinking, identification of variables, design of strategies and procedures, analysis of results, etc.	Provide enough support, avoid cookbook work, develop grading rubrics, safety issues	Lab work, field work, individual or teams (usually teams).	Non-majors biology inquiry projects

<http://ublib.buffalo.edu/libraries/projects/cases/teaching/whatis.html> First, it is evident that in all instances cases are stories, usually real stories. Second, it is evident that teachers using cases are not all delivering these stories the same way. There is no "case method" (except perhaps in business). Conant used cases with the lecture method. Law school teachers use Socratic questioning. Business school instructors use discussion leading. Medical school tutors use small group cooperative learning called problem-based learning. Third, the subject matter definitely determines the nature of the cases and their expected conclusions. Some cases (and perhaps the method of teaching) are fact driven and deductive, i.e., there is a correct answer. Other cases are context drive, i.e., multiple solutions are reasonable. The best answer depends upon the situation at the moment.

http://www.samford.edu/ctls/pbl_background.html Problem-based learning is a development and instructional approach built around an ill-structured problem which is mess and complex in nature; requires inquiry, information-gathering, and reflection; is changing and tentative; and has no simple, fixed, formulaic, "right" solution (Finkle & Torp, 1995).

<http://www.psychologicalscience.org/observer/getArticle.cfm?id=1955> Within this framework, QR involves (a) appreciating the value of quantitative approaches to understanding, (b) being willing to use QR electively in constructing an argument, (c) knowing or knowing how to find or generate relevant quantitative information, (d) evaluating implicit and explicit quantitative claims in light of relevant standards and critical issues, and (e) representing and communicating quantitative information or evaluations in a clear, informative, and responsible manner.

<http://www.pogil.org/info/introduction.php> A POGIL classroom or lab consists of any number of students working in small groups on specially designed guided inquiry materials. These materials supply students with data or information followed by leading questions designed to guide them toward formulation of their own valid conclusions - essentially a recapitulation of the scientific method. The instructor serves as facilitator, observing and periodically addressing individual and classroom-wide needs".

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