Nashville State Technical Community College
Quality Enhancement Plan—August 2007

Annotated Bibliography of Critical Thinking Resources

Angelo, Thomas. "Classroom Assessment for Critical Thinking." ***Teaching of Psychology*** **22 (1995): 6-7.**

Thomas Angelo first reviews the literature on effective teaching for critical thinking: Students learn better when they are actively engaged and personally involved in their learning, when they receive timely and clear feedback, and when they work together with peers and instructors. Faculty can improve the likelihood that students will improve critical thinking by planning and conducting class discussions, teaching problem-solving skills, providing guided practice, assessing students' abilities to solve problems, modeling metacognition in problem solving, and continuously modeling students' progress throughout the semester. One way to do this is through Classroom Assessment Techniques, such as the minute paper, which requires students to reflect on and explain the learning that has taken place. Then the instructor provides feedback on weaknesses and points for further discussion.

Are They Ready to Work? **15 Aug. 2007**
<<www.21stcenturyskills.org/documents/ReportCardFINAL_updated.pdf>>.

This survey is conducted by The Conference Board, Partnership for 21st Century Skills, Corporate Voices for Working Families, and the Society for Human Resource Management.

Argument Mapping Tutorials. Austhink. 7 Dec. 2006. 15 Aug. 2007
<<www.austhink.com/reason/tutorials/>>.

This is part of the Austhink site, which publishes mapping software. Faculty will also find much helpful information at the site, particularly the tutorials. They start with an overview of argument mapping then provide the reader with an article presenting and then debunking hoax claims for the Apollo moon landing. A series of quizzes follows, which help students analyze the specific parts of arguments. (This is an Australian site, so expect British spelling in the tutorials.)

Aviles, Christopher. "Teaching and Testing for Critical Thinking With Bloom's Taxonomy of Educational Objectives." 2000. ERIC: ED446023.

Christopher Aviles advises social work educators to use Bloom's taxonomy when thinking about teaching critical thinking in their classrooms. He presents all six levels with examples of test questions for each one. This is a useful overview of the taxonomy for instructors who may not be familiar with the levels.

Baggini, Julian. "Bad Moves." 2003. 15 Aug. 2007 <<www.butterfliesandwheels.com/badmoves.php>>.

Philosopher Julian Baggini takes quotations from the news and explains the fallacies behind each statement. They are very interesting little studies although they tend to be England-centered.

Bassham, Gregory, and Henry Nardone. "Using the Film *JFK* to Teach Critical Thinking." *College Teaching* 45 (1997): 10-13.

The two philosophy professors discuss an assignment they use to build their students' critical thinking skills. They assign the movie *JFK* and then require students to work in groups to verify or refute the various claims made in the film. As the authors note, 'Critical thinking texts . . . continue to focus almost exclusively on the parsing and evaluation of written arguments. As a result, many students are easily misled, and they ignore the importance of applying critical thinking to the electronic mass media, with its special challenges."

Bean, John. *Engaging Ideas: The Professor's Guide to Integrating Writing, Critical Thinking, and Active Learning in the Classroom.* San Francisco: Josey-Bass. 1996.

In this very useful resource on practical ways to infuse the curriculum with critical thinking activities, John Bean provides a clear description of the link between critical thinking and writing.

Bers, Trudy, Marilee McGowan, and Alan Rubin. "The Disposition to Think Critically Among Community College Students: The California Critical Thinking Dispositions Inventory." *The Journal of General Education* 45 (1996): 197-223.

This was a study of five courses: English Composition II, Introduction to Psychology, Effective College Reading, Introduction to Life Science, and Intermediate Algebra. Students in these courses were given the CCTDI as a pre- and post-test as a way of measuring whether instruction changed their dispositions toward critical thinking. They did find that the following groups showed a stronger disposition toward critical thinking: older students (over 25), females, and those who had more education. But instruction seemed to have little effect on students' dispositions. Improvements were minimal, and in some cases, scores went down on the post-test, leading the researchers to hypothesize that meaningful change in disposition can't take place in 16 weeks. Critical thinking dispositions were positively correlated with grade point averages.

Beyer, Barry. *Practical Strategies for the Teaching of Thinking.* Boston: Allyn & Bacon. 1987.

Although out of print, this book is a great resource for helping faculty clarify how best to teach critical thinking. Barry Beyer points out some key elements for effective instruction in critical thinking:

- Critical thinking must be taught explicitly.

- Critical thinking cannot be taught as an adjunct in a single course–it must be integrated in as many courses as possible across the curriculum.
- To be effective, critical thinking instruction should be taught at the cognitive and metacognitive levels. The thinking processes of the both the student and instructor must be made explicit.
- Critical thinking operations must be developed and strengthened over time.
- Critical thinking skills must be taught within the context of courses in order to reinforce them and prevent them from becoming inert knowledge.
- Critical thinking should be assessed by different types of assessment instruments to get a true picture of student progress.
- Assessment should get at the students' underlying thought processes.
- A critical thinking disposition must be developed in students.

Bidwell, Sheri. "Teaching Students to Solve Problems." ***Handbook II: Advanced Teaching Strategies for Adjunct and Part-time Faculty.*** **Ed. Donald Greive. Elyria: Info-Tec. 2000: 79-84.**

Sheri Bidwell stresses the importance of teaching problem-solving skills in the context of the course. She mentions the IDEAL method of problem solving:

- **I**dentify the problem.
- **D**efine the problem.
- **E**xplore alternative approaches.
- **A**ct on a plan.
- **L**ook at the result.

She also stresses the importance of assigning open-ended problems as being the most effective way to prepare students for the workplace.

Bissell, Ahrash, and Paula Lemons. "A New Method for Assessing Critical Thinking in the Classroom." ***BioScience*** **56 (2006): 66-72.**

The authors discuss their own attempt to assess critical thinking skills in introductory biology classes at Duke University. They note that while many faculty say they want their students to think critically, they themselves are often hard-pressed to define it or show they are teaching it in their classrooms. Ahrash Bissell and Paula Lemons give two reasons for this: (1) The proliferation of critical thinking definitions (The authors note their approach was to pick one and use it consistently), and (2) Faculty have difficulties in measuring critical thinking skills. While research shows that general critical thinking tests do correlate to students' performance in a course, many faculty do not use them for the following reasons: They do not measure content-specific skills; they can be costly both in expense and the time they take away from instruction; and many instructors do not understand the theory behind the test. Therefore, the authors developed a course-specific assessment, using the following steps:

1. Write questions that require both content and critical thinking skills.

2. Develop a rubric for the required content and CT skills.
3. Have colleagues review them.
4. Administer to students.

The authors found the assessment method itself affected the course positively and are now more explicit with students about the skills they will need to master to be successful.

Black, Paul, and Dylan William. "Inside the Black Box: Raising Standards through Classroom Assessment." *Phi Delta Kappan* 80 (1998): 139-148.

In their survey of the research on the subject, Paul Black and Dylan William found that formative assessment raises standards of achievement and formative assessment helps low achievers more than any other students. Formative assessment provides necessary feedback that allows students to learn from their mistakes and improve their learning. One thing the authors emphasize is the necessary hard work that must be undertaken to come up with good questions.

Braun, Nora. "Critical Thinking in the Business Curriculum." *Journal of Education for Business* 79.4 (2004): 232-36.

Nora Braun first documents the need for critical thinking in the business world. For example, in one survey, 44 percent of managers believe that issues are not clearly defined before being addressed. Braun proceeds to examine what business schools are doing to teach critical thinking, to see whether such instruction has made a difference, and then to make recommendations for the future. She finds that three basic methods are being used: problem-based learning, course-content-embedded learning, and critical thinking as an underlying element. Case studies have been traditionally used in business classes with success. But Braun notes that instructors must be more proactive than simply assigning students cases to read; instructors must model critical thinking and guide them in critical dialogue about the case. Course-embedded methods include discussions, questions in class, debates, and group exercises. The emphasis is on learning thinking skills about business rather than a set of concepts. Critical thinking is often used as an underpinning for other pedagogies when students are encouraged to look at the societal effects of business practices. Braun then notes several specific issues:

1. The most successful approach is to teach critical thinking explicitly. But, Braun says, there will be tension between how much time should be given to critical thinking and, if it is increased, how much area content should be reduced.
2. The issue of building skill levels in critical thinking needs to be addressed.
3. The most often mentioned assessments tend to be those of student evaluations of instructors and reflections, rather than actual student outcomes.

Brown, M. Neil, and Michael Meuti. "Teaching How to Teach Critical Thinking." *College Student Journal* 33 (1999): 162-70.

The authors point out that critical thinking is one of the most named learning objectives for students, yet classroom practice does not emphasize such skills. They delineate an effective process in developing and conducting instructional workshops in critical thinking for faculty:

1. Upper administration must demonstrate their commitment to critical thinking.
2. Faculty must play an active role in the development of the program.
3. Both professional development and instructional development must be encouraged on the campus.
4. The workshops should be active, including microteaching and peer review exercises.
5. The workshops should be reinforced with activities, such as faculty observing each other's classes, sharing syllabi and lesson plans, and identifying faculty who will serve as critical thinking mentors.

Buffington, Melanie. "Contemporary Approaches to Critical Thinking and the World Wide Web." *Art Education* Jan. 2007: 18-23.

Melanie Buffington reiterates the importance of understanding the definition and types of thinking that is being taught in the classroom to be effective. She notes three approaches using the web that are relevant to art education: studying controversial social issues and various interpretations of art works, as well as Webquests (*see* the Whitney Museum of American Art site for an example of one on Jacob Lawrence). Two of her conclusions seem especially relevant for community college students:

1. If students are not instructed in the most effective use of the web, their searches will be superficial.
2. It might be wise to begin with a pre-selected list of websites to help students get a sense of the sources that will be considered appropriate for a course.

Burbach, Mark, Gina Matkin, and Susan Fritz. "Teaching Critical Thinking in an Introductory Leadership Course Utilizing Active Learning Strategies: A Confirmatory Study." *College Student Journal* 38 (2004): 482-494.

The researchers studied several sections of an introductory leadership course that implemented several of the instructional strategies that have been linked to improved critical thinking: journal writing, service-learning projects, small groups, case studies, and questioning. Using the Watson-Glaser Critical Thinking Appraisal as a pre- and post-test, the study showed gains in critical thinking among the students in the course.

Carlson, J. Lon, and Neil Skaggs. "Learning by Trial and Error: A Case for Moot Courts." *The Journal of Economic Education* 31 (2000): 145-55.

The authors describe the moot courts they use in their economics classes. They find that students are more engaged and have to do more critical thinking by pulling together the information and examining the evidence carefully for their presentations.

Carroll, Robert Todd. "Critical Thinking Mini Lessons." 20 Apr. 2007. 15 Aug. 2007 <<http://skepdic.com/refuge/ctlessons.html>>.

This useful site by philosopher, professor, and author Robert Todd Carroll offers thirteen mini lessons on the following topics:

1. Induction and Deduction
2. The Concept of Validity
3. The Wason Card Problem
4. The Wason Card Problem, Part II
5. Fallacies
6. Replication of Studies
7. Fallacy of Suppressed Evidence
8. Replication Revisited
9. The Straw Man Fallacy
10. Control Group Study
11. False Dichotomy
12. False Implication
13. Perception Deception

Also, the site offers a good introduction to critical thinking for students, by Greg Haskins based on Carroll's books.

Costa, Arthur, ed. *Developing Minds: A Resource Book for Teaching Thinking. 3rd ed.* Alexandria: Association for Supervision and Curriculum Development, 2001.

This resource contains 85 short papers broken down into 11 sections. Of particular interest are the following papers:

- *Teaching Thinking Skills–Defining the Problem.* These articles discuss appropriate and inappropriate methods for teaching thinking skills.
- *Thinking Across the Curriculum.* The articles discuss the necessity for integrating thinking skills across the curriculum and the problems associated with one-shot efforts.
- *Techniques for Teaching Thinking*. Each article addresses the actual techniques effective in teaching thinking. One theme predominates: The necessity for teaching thinking explicitly rather than making the assumption that critical thinking will somehow evolve naturally during instruction. To be effective, instruction and assessment should make student thinking a significant part of both.

***Critical Thinking Across the Curriculum Project*. Longview Community College. 2 Mar. 2004. 15 Aug. 2007 <<http://mcckc.edu/longview/ctac/toc.htm>>.**

This site at Longview Community College in Missouri has some good resources for faculty. Also, the short overview of logic might serve as a good introductory reading for students. The site offers a good list of resources for teaching critical thinking in various disciplines.

***The Critical Thinking Community*. 2007. 15 Aug. 2007 <<www.criticalthinking.org/>>.**

A site by the Foundation for Critical Thinking, this excellent resource for instructors and students offers short articles on the basics of critical thinking for both faculty and students, as well as some good articles on designing instruction around critical thinking principles.

***CSS Impact: Case Studies of Problem-Based Learning Experiences*. Nashville: Center for Information Technology Education, 2006.**

Based at Nashville State, the CITE projects hold promise for critical thinking instruction. The CITE program's goal is to improve the educational experience of students by incorporating problems that require the same skills and knowledge they will need on the job. By using real-life work problems, students are faced with "messy" problems that defy neat answers. They must analyze and evaluate, then make necessary corrections to any errors in thinking.

D'Angelo, Barbara. "Using Source Analysis to Promote Critical Thinking." *Research Strategies* 18 (2001): 303-09.

Barbara D'Angelo reports on cooperation between a business class and a librarian to teach students how to critically analyze sources in preparing for a project on different countries. By helping students see the differences in sources and in showing them how to ask the right questions about possible sources, their ability to find appropriate sources for their projects improved.

Dewey, John. *How We Think*. 1910. Mineola, NY: Dover, 1997.

Many people consider John Dewey to be the preeminent American philosopher. Originally published in 1910, this masterpiece work covers the entire area of human thinking. For those interested in a nice introduction to thinking, including the areas that are crucial to critical thinking, this short book (224 pages) is definitely worthwhile.

Dooley, Kim, and Leah Wickersham. "Distraction, Domination, and Disconnection in Whole-Class, Online Discussions." *The Quarterly Review of Distance Education* 8 (2007): 1-8.

Although this small study centered on a graduate class of education students, the results should provide some reflection for all online instructors. First, noting that a previous study found that smaller virtual learning communities within a class did incorporate critical thinking in their discussions, the authors wanted to look at whole-class discussions. While critical thinking was present, they found the following three disturbing trends not present in the smaller learning communities:

1. A higher number of off-topic discussions
2. Domination of the discussions by one or two people
3. Less integrated critical thinking responses

Douglas, Nancy. "Enemies of Critical Thinking: Lessons from Social Psychology Research." *Reading Psychology* 21(2000): 129-144.

Nancy Douglas argues that educators must take into account the psychological factors that inhibit students' critical thinking skills. The first is human credulity: the propensity to believe ideas placed before them. (Many young students want to be told the "truth" by the text or the instructor.) Second is the fact that people tend to hold to initial beliefs despite evidence to the contrary.

Edmundson, Louie. "Critical Thinking: It Begins at Home." *Academic Exchange Quarterly* 4.3 (2000): 136.

Louie Edmundson challenges teachers to review their own critical thinking skills. He notes that:

> If we model critical thinking practices ourselves, if we emphasize solving problems with all relevant technologies, if we teach in ways that cut across disciplines, and if we develop programs and strategies that emphasize disciplined and self-aware thought, analysis, creativity, intellectual courage, and openness to ideas old and new, we can be genuinely effective in preparing our students for work and for life in the contemporary world.

Elder, Linda. "Critical Thinking as the Key to the Learning College: A Professional Development Model." *Critical Thinking: Unfinished Business*. Ed. Christine McMahon. *New Directions for Community Colleges.* San Francisco: Josey-Bass, 2005: 39-48.

Linda Elder provides a useful model for professional development as a way to build a Learning College. She first names the components for a successful program, including administrative support, an advisory team, a long-term view, ongoing faculty and staff workshops, and a link between critical thinking and assessment, accreditation, and the institution's mission.

---, and Richard Paul. "Critical Thinking and the Art of Substantive Writing, Part III." *Journal of Developmental Education* 30. 1 (2006): 32-33.

In this article, Linda Elder and Richard Paul discuss two assignments that help students learn to write more critically. The first is to explore key ideas within disciplines, in which students define, paraphrase, and give examples and analogies of key concepts. The second is to investigate conflicting ideas on a topic.

---. "Critical Thinking and the Art of Close Reading Part IV." *Journal of Developmental Education* 28. 2 (2004): 36-37.

A continuation of earlier articles that explore the importance of college students' ability to understand a writer's purpose, the interconnection of text, systems of meaning, impressionist reading, and formulation of questions while reading, this article outlines the skills necessary to read on four levels, from the most basic to increasingly complex reading skills. The first level is the ability to paraphrase a text while keeping the meaning. Level two is the ability to explicate the thesis of a paragraph, including stating

the thesis, explaining the thesis, giving examples from the real world, and creating an analogy, metaphor, or visualization of the thesis to connect it to schema. The next level is the analysis of the author's reasoning. The authors list eight essential questions that the reader should consider, including the purpose of the material, the key question the author is addressing, the facts or data used to support conclusions, the inferences and key concepts required to understand the information, as well as the assumptions, implications and points of view presented by the writer. The fourth level is evaluating the logic of a reading for "clarity, precision, accuracy, relevance, significance, depth, breadth, logic, and fairness." The authors state that most students lack the skills required to read at a deep and substantive level.

Etheridge, Sharon. "Learning to Think Like a Nurse: Stories from New Nurse Graduates." *The Journal of Continuing Education in Nursing* 38.1 (2007): 24-30.

While aimed at nursing, this article also provides some relevant information for critical thinking in any area. Recent nursing graduates, in a series of three interviews, noted how much critical thinking, decision making, and problem solving they had to do on the job and how they felt unprepared for it. One lesson for NSCC programs might be that we could make critical thinking more relevant to students through a series of interviews with former graduates who talk about the critical thinking that is necessary for their jobs.

Facione, Noreen, and Peter Facione. "Assessment Design for Evaluating Critical Thinking in Nursing." *Holistic Nursing Practice* 10.3 (1996): 41-53.

Although focused on nursing, this article provides a good overview of the issues surrounding any assessment program of critical thinking. The authors make the point that when using professional judgment, critical thinking involves both the skills, such as analysis and evaluation, and the habits of mind, such as confidence and inquisitiveness. Therefore, there need to be ways to assess both aspects. They recommend the portfolio as a method for assessing group learning outcomes. In this method, independent evaluators assess the work in a way that ensures objectivity and reliability. They also mention sources of data that could be considered when assessing critical thinking: objective tests, literature critiques, intervention plans, class presentations, employer interviews, clinical evaluation forms, filmed simulations of problem solving, student self-evaluations, etc. One interesting point the authors make is that writing is a separate outcome from critical thinking, and it is important to assess the two separately.

Facione, Peter. "Critical Thinking: A Statement of Expert Consensus for Purposes of Educational Assessment and Instruction." Executive Summary of *The Delphi Report*. Millbrae: California Academic Press, 1990.

The findings of *The Delphi Report* are the basis for much of the critical thinking instruction for the past two decades. Peter Facione summarizes the findings and reports on the recommendations:

- All CT instruction should aim at developing good critical thinkers in the classroom and in their everyday lives.
- There should be a holistic conceptualization of what it means to be a good critical thinker.
- A solid liberal education supplements the honing of critical thinking skills and the cultivating of critical thinking dispositions.
- Modeling and developing a critical spirit is an important goal and should be assessed.
- It is as important to develop instruction and assessment for the affective critical thinking dispositions, as well as for the cognitive critical thinking skills.
- Critical thinking instruction should begin in early childhood.
- The goal of all critical thinking instruction should be to further students in the development of their critical thinking cognitive skills and affective dispositions.
- Direct instruction and assessment in critical thinking should be an explicit part of any course granted approval for satisfying the critical thinking requirements.
- Critical thinking instruction should be at all levels of education.
- Critical thinking instruction should be part of the K-12 curriculum.
- Critical thinking proficiency expectations should be set at each stage of education.
- Validity, reliability, and fairness should be considered in any critical thinking assessment tool.
- Critical thinking assessment should occur often and be formative, as well as summative.
- Instructors should model critical thinking dispositions and skills during the course of instruction.
- If teachers are expected to model critical thinking, so should all who have a role in teacher preparation and professional development.

---. "Critical Thinking: What It Is and Why It Counts." 2007 Update. *Insight Assessment*. 2007. 15 Aug. 2007 <<www.insightassessment.com/pdf_files/what&why2007.pdf>>.

Peter Facione gives a good overview of what critical thinking is, the elements involved in critical thinking and the crucial dispositions. Aimed at students, this would make a good introductory assignment for a unit on critical thinking or a good review for new and adjunct faculty.

Garcia, Teresa, and Paul Pintrich. "Critical Thinking and Its Relationship to Motivation, Learning Strategies, and Classroom Experience." Washington: Centennial Annual Convention of the American Psychological Association, 1992. ERIC: ED351643.

The "Motivated Strategies for Learning Questionnaire" was given to 758 Midwestern college students at both the beginning and the end of the 1988 winter school term to identify the relationships among motivation, learning strategies, and classroom experiences and critical thinking. Some of the findings:

- Intrinsic goal orientation relates to "deeper" learning and may positively correlate with critical thinking.
- Use of deeper learning strategies (organizing material from simple to complex, paraphrasing, summarizing, analogies, and metacognitive awareness with self-regulation) tends to support critical thinking.
- Small peer groups and instructors who are seen as enthusiastic and responsive appear to positively affect the students' motivation, which may also positively affect critical thinking.
- Students' perception of course difficulty did not seem to be related to critical thinking.
- Post-test English students reported they used higher levels of critical thinking than did students in biology or social science classes even though biology was thought to be more difficult than English or social science.

Based on this study, some of the things we do in Learning Strategies classes may encourage critical thinking, but we need to do more to encourage the development of intrinsic motivation and metacognitive awareness in our students.

Greenlaw, Steven, and Stephen DeLoach. "Teaching Critical Thinking With Electronic Discussion." *Journal of Economic Education* 34:1 (2003): 36-52.

After studying the literature, the authors point out that two pedagogies are prominent in the critical thinking literature: writing and discussions. They believe that electronic discussions provide the best of both techniques. After noting the difficulties inherent in assessing critical thinking in a classroom session, the authors developed a scale that focused on how students argued in their discussion, ranging from unsupported assertions to value judgments based on disciplinary criteria. But they point out that these discussions need to be planned carefully. The discussions must be seen as an integral part of the course, not as optional or extra credit. Professors must word their questions carefully to elicit high-order answers. Students must be provided with some instruction on what sort of answers are being elicited. Faculty members must provide feedback to students. The authors provide examples of discussion questions they use, answers at all levels of critical thinking, and the procedures handout they give to students on the assignments.

Gupta, Gian. "Progressive Questioning: Improving Students' Critical-Thinking, Logic, and Problem-Solving Skills." *Journal of College Science Teaching* Jan./Feb. 2005: 48-51.

Gian Gupta describes changing a class from lecture to one that emphasizes progressive questioning, case studies, laboratory exercises, and research. While taking more time than lecture and not being able to cover the entire textbook, there were many positive outcomes to the changed course: increased class participation, improved test scores, and better performance in laboratory exercises and independent research.

Hall, Mark. "Thinking Crisis." *Computerworld* 27 Nov. 2006: 18.

Mark Hall reports on the most recent results from ACT on the Information and Communication Technology (ICT) Literacy Test. Of college and high school students, 52 percent could determine whether a web page's information was objective. Sixty percent didn't realize that using multiple terms in a search could improve the quality of results. More than half were unable to complete an online assignment and report their results with accuracy. Hall concludes that we have made an error in thinking that because students can use technology, they know how to use it critically and logically. He surmises that this is one of the reasons many CIOs are looking overseas for new hires.

Halpern, Diane. *Critical Thinking Across the Curriculum: A Brief Edition of Thought and Knowledge.* Mahwah: Erlbaum, 1997.

Table 3.1 on page 69 is particularly good. Titled "Guiding Thought-Provoking Questions," the table provides a lengthy list of question examples paired with the specific thought skills induced. Diane Halpern also has an extensive section covering how to handle "if, then" statements. Beginning on page 124 is a discussion of 21 common fallacies in critical thinking.

Hatcher, Donald. "Stand-Alone Versus Integrated Critical Thinking Courses." *JGE: The Journal of General Education* 55 (2006): 247-272.

Donald Hatcher notes that the research at Baker University shows that integrated courses are more effective than stand-alone critical thinking classes. The University implemented a two-semester critical thinking and composition sequence. Skills taught included paraphrasing, summarizing, evaluating arguments, and using valid argument patterns to develop strong papers. The papers were graded using a standard rubric. Subsequent analyses found that students in the integrated course made significant pre- to post-test improvements on the Ennis-Weir Critical Thinking Essay Test, the California Critical Thinking Skills Test, and the Cornell Level Z Critical Thinking Test. These students also outperformed those in stand-alone courses. An example of an effective grading rubric is included.

Henninger, Edward, and Janet McNeil Hurlbert. "Critical Thinking and Information Across the Undergraduate Business Curriculum." *Journal of Business & Finance Librarianship* 2 (1996): 29-40.

The authors report a project that builds a sequence of critical thinking exercises into the lower-level prerequisite business courses. They note, as have many other authors, that covering as many topics as possible may not be as important as designing learning experiences that shape critical thinking skills. The project has the following steps:

1. A topic is chosen that students in an introductory course will find interesting or relevant. The authors note it is important that the students believe the instructor finds the topic and the exercise relevant, not just a library exercise.
2. Students attend a library workshop where they discover how to find articles. The emphasis here is not on finding a number of articles, but on finding information that will convince an audience and make a point.
3. Pairs of students are assigned the task of finding an article on the topic.
4. A typed critical review of the article is assigned with an oral report, requiring the groups to state why they chose the article, the main points of the article, and how the article relates to Deming's Fourteen Points or another standard set of criteria.

Herman, Jerry. "Thwarting Expectations: Assignments From a Critical Thinking Class." *New Directions for Community College* 130 (2005): 69-77. Wilson Web. Nashville State Community College, Nashville, TN. 3 Oct. 2006 <<http://vnweb.hwwilsonweb.com>>.

The paper describes coursework in a critical thinking class that the author designed, teaches, and continues to refine. He details three assignments proven effective in challenging student assumptions and expectations in order to develop three skills necessary for critical thinking. The first assignment stresses accurate observation. The second redefines facts and certainties as fluid and mutable rather than static and unchanging. Finally, the third assignment, a group project, is designed to help students synthesize all of the critical thinking skills developed throughout the semester. The assignments suggest it is possible to teach students how to think and, also, to change the way they think.

Herreid, Clyde Freeman. "Can Case Studies Be Used to Teach Critical Thinking?" *Journal of College Science Teaching* May 2004: 12-14.

Clyde Freeman Herreid notes that there must be both mindset and content in order to teach critical thinking. He includes the following habits of mind as crucial to critical thinking: problem solving, skepticism, flexibility, and the capacity to find different ways to approach a situation, with skepticism being the most crucial. He finds that case studies are one of the best ways to develop critical thinking skills, since by their very nature they require students to ask for and evaluate evidence. He recommends the "Interrupted Case Method" where students are periodically asked to stop and evaluate and then are given more information. There are some good examples at the National

Center for Case Study Teaching in Science website: **http://ublib.buffalo.edu/libraries/projects/cases/case.html.**

Hittner, James. "Fostering Critical Thinking in Personality Psychology: The Trait Paper Assignment." ***Journal of Instructional Psychology*** **26 (1999): 92-97.**

James Hittner reports on his assignment of a research paper based on personality traits. To encourage critical thinking in his students, he centers the paper around some essential questions: Where does the personality trait develop in humans? What purpose does the trait appear to serve? How does the trait affect the person's social behavior? What methods might be used to increase or decrease the quantity of the trait? Using questionnaires, students reported the paper was effective in stimulating critical thinking.

Huba, Mary, and Jann Freed. ***Learner-Centered Assessment on College Campuses: Shifting the Focus From Teaching to Learning.*** **Boston: Allyn and Bacon, 2000.**

While all of the chapters contain helpful information on assessing by using student outcomes, two are especially relevant in the assessment of critical thinking. The first deals with rubrics, a tool often mentioned in the critical thinking literature. The second is on the assessment of critical thinking through ill-defined problems. Both chapters contain good examples of practical assessment strategies.

Hynd-Shanahan, Cynthia, Jodi Patrick Holschuh, and Betty Hubbard. "Thinking Like a Historian: College Students' Reading of Multiple Historical Documents." ***Journal of Literacy Research*** **36 (2004): 141-76.**

This small study of three Learning to Learn classes consisted of questionnaires and personal interviews. The history section of the course requires students to read conflicting texts about the Vietnam War and write an essay. During the process, the interviewers found that most of the students moved from concrete thinking to thinking like a historian: evaluating sources, placing events in context, and finding corroborating information.

The IDEA Center Papers**. 15 Aug. 2007 <<www.idea.ksu.edu/podidea/index.html>>.**

These short papers deal with many aspects of teaching and learning. Several focus on elements related to critical thinking.

Insight Assessment**. 2006. 15 Aug. 2007 <<www.insightassessment.com/>>.**

The publisher of the California Critical Thinking Skills Test and the California Critical Thinking Disposition Inventory, this site also has a good page on teaching tips: **www.insightassessment.com/teachtips.html**, with examples of test questions, rubrics, syllabi, etc.

Johnson, Jim, and Ruth Loring. "Problem-Based Case Learning: The Case Files." *Learning Abstracts* 9.11 (Nov. 2006). League for Innovation in the Community College.

This is a description of the Case Files, a successful program developed at NSCC, which provides a good overview for any faculty member who might want to include a similar project in class. The Case Files develop around real-world, open-ended business and industry problems, require teamwork and multiple perspectives, and have more than one solution. One student outcome of the project has been to improve the quantity and quality of responses to problem finding and problem solving.

Knievel, Jennifer, and Becky Imamoto. "Integrating Information Literacy and Writing." *Academic Exchange* 9.3 (2005): 340-343.

The authors report on a program at the University of Colorado at Boulder that integrates information literacy and composition instruction. These two skills share much in common: critical thinking, evaluation, integration, and research. This program has four sections: reading themes (instead of textbooks, first-year composition classes are based on one of 11 themes with readings coming from the library databases), research instruction online tutorial, a library seminar conducted after the students have chosen their topics, and a drop-in research center.

Lampert, Nancy. "Enhancing Critical Thinking With Aesthetic, Critical, and Creative Inquiry." *Art Education* 59.5 (2006): 46-50.

As Nancy Lampert notes, studies have shown that fine arts programs containing aesthetic, critical, and creative attributes have students who are more disposed to critical thinking, as well as more likely to transfer those skills to subjects outside of art. She discusses four basic techniques that teachers can use to encourage critical thinking. Basically, the strategies ask that instructors allow for disparate points of view and that students be encouraged to contrast different works of art and provide evidence for their conclusions and theories. Lampert notes that a basic technique from Barrett has possibilities for instructors of many areas. It involves helping students ask themselves three questions about a piece of art: What do I see? What is the artwork about? How do I know?

Lee, Kathryn. "Enhancing Critical Thinking in Online Learning." *Academic Exchange Quarterly* 9.4 (2005): 43-48.

Kathryn Lee studied 80 students enrolled in a mandatory college success course. All were given a critical thinking pre- and post-test. All students were required to work on a series of case studies. One group worked individually; the second was required to work in online discussion groups. While it was hypothesized that the second group would show greater gains on the post-test, that did not happen. Both groups did improve on the post-test. Lee hypothesizes this happened for several reasons: the nature of case studies, the explicit instruction, timely feedback, and the number of cases required.

Meyerdierks, Bradford, et al. "Idea Bank." *Music Educators Journal* 83.6 (1997): 46-48.
The Idea Bank is a response to a question posed in an article in the July 1996 *MEJ* concerning the incorporation of critical thinking skills in music courses. Ideas from music teachers are presented to demonstrate how they incorporate critical thinking skills in their classrooms. Techniques discussed include compare and contrast, thought-provoking questions, and a research project combining music and science.

Miholic, Vincent. "Using Photography to Heighten Critical Thinking." *Journal of College Reading and Learning* 28.2 (1998): 111-17.
Vincent Miholic discusses the use of photography to improve student critical thinking. He explains an assignment where students are divided into groups, and each group is given a topic to analyze. Each person in the group is given a camera to create photographs that exemplify a chosen abstract concept (beauty, communications, fads, habitat, wealth, etc.). After each person in the group creates a photograph, the images are evaluated as to whether or not each image is an accurate reflection of the abstract concepts. The visual nature of the photographs gives the instructor and students something concrete to discuss to see whether or not the students fully understand the abstract concepts chosen for the project. One of the questions the students are asked when returning with the photographs is "What information present in your photographs specifically supports the concept?" The students are then asked to evaluate the other photos to determine which are the most successful at communicating the given concept. This is a great example of the type of critical thinking that goes into making photographs for almost any purpose–advertising, journalism, fine art, or even portraiture. The photographer decides what to include (or not include) in the frame to better tell the story or sell the item being advertised.

Moore, Brooke, and Richard Parker. *Critical Thinking*. 6th ed. Mountain View: Mayfield, 2001.
This basic text on critical thinking is used by NSCC philosophy classes. The working definition of critical thinking used by the QEP team is from this text.

Muir, Clive. "Using Consulting Projects to Teach Critical-Thinking Skills in Business Communication." *Business Communication Quarterly* 59:4 (1996): 77-87.
Clive Muir posits that students do not realize the political and social constrictions involved with writing on the job. He describes an assignment that puts groups of students in the position of consultants in projects from actual businesses or departments at the university. By having to work on real-world projects, students are forced to contend with the financial and social constraints that occur in the workplace. But while Muir believes the project was a success, he notes that there was not enough time to cover all the topics in their text.

Murphy, Elizabeth. "An Instrument to Support Thinking Critically about Critical Thinking in Online Asynchronous Discussions." *Australasian Journal of Educational Technology* 20.3 (2004): 295-315. 1 Dec. 2004. 15 Aug. 2007 <<www.ascilite.org.au/ajet/ajet20/murphy.html>>.

Elizabeth Murphy begins by noting that engagement in a course is not a result of the medium of communication, but of instructional design, as well as other factors. Therefore it is important to consider what the discussions should be accomplishing and find a way to assess that the goals are met. Synthesizing four models of critical thinking (Brookfield; Norris and Ennis; Bullen; and Garrison, Anderson, and Archer), she proposes an instrument that analyzes critical thinking in discussions, looking at four phases: recognition, understanding, analysis, evaluation, and creation. Each area has several specific indicators. While probably too cumbersome to use as a rubric alone for NSCC purposes, it could be a helpful tool in developing a rubric or in evaluating the discussion questions that faculty place online.

Nilson, Linda B. *Teaching at Its Best: A Research-Based Resource for College Instructors.* 2nd ed. Bolton, MA: Anker, 2003.

In this excellent resource for instructors who may have not have had much pedagogical training, Linda B. Nilson discusses several ways to make classes more active and students more involved in their own learning. Chapters include learning styles, student-active teaching, discussions, experiential learning, group learning, writing assignments, and problem solving.

Nixon-Cobb, Elisha. "Visualizing Thinking: A Strategy That Improves Thinking." *The Teaching Professor* Jan. 2005: 3, 6.

Elisha Nixon-Cobb reports on a strategy involving a pre- and a post-activity that requires both summarizing an article and a concept map. When students visualize how they put ideas together, they end up with better papers that show higher order thinking skills.

Nosich, Gerald. "Problems With Two Standard Models for Teaching Critical Thinking." *New Directions for Community Colleges* 130 (Summer 2005): 59-67.

Gerald Nosich argues that critical thinking instruction is at the heart of every discipline and critiques the two current methods of including critical thinking in college classes. The first method is called the "one of many" approach, in which the instructor includes critical thinking as only one method of many in teaching the subject. He notes that textbooks often follow this approach, often breaking down questions at the end of the chapter into rote (the majority) and critical thinking (the minority). The second method is "cover as much content as possible." This is often a common textbook approach, as well. Nosich finds that neither method truly works for teaching critical thinking:

1. Such methods are by their very nature anticritical, not neutral. The act of assigning definitions without context of analysis implies that knowledge can be learned in a vacuum.

2. Students come to campus with some sort of thinking skills, often noncritical. It is naïve to assume they will approach knowledge neutrally–They may come to classes with inaccurate, disconnected ideas about a subject, but they come with ideas.

Nosich makes the following recommendations:

1. Faculty must focus on what is most central in a course and how the discipline works as a whole.
2. They must teach the discipline as a system of thinking.
3. The focus should be on a few key concepts and how they fit together.
4. Students should use those key concepts through a wide variety of problems, ideas, and situations in the field.

Paul, Richard. "The State of Critical Thinking Today: The Need for a Substantive Concept of Critical Thinking." ***The Critical Thinking Community*****. Fall 2004. 15 Aug. 2007 <<www.criticalthinking.org/resources/articles/the-state-ct-today.shtml>>.**

Richard Paul begins with three current problems of higher education:

1. Most instructors do not really know what critical thinking is.
2. Even worse, they don't know that they don't know.
3. Most instructors still depend on lecture and memorization in their classes.

Paul argues that higher education must commit to a more substantive view of critical thinking with content being taught through thinking, not the other way round. The critical thinking deficit at the college level will not be solved by adding a critical thinking course to the curriculum, nor by adding mandatory study skills courses. Each course must be built around critical thinking.

- - -, and Linda Elder. ***Critical Thinking: Tools for Taking Charge of Your Professional and Personal Life.*** **Upper Saddle River: Pearson, 2002.**

In this book, Richard Paul and Linda Elder apply their ideas on critical thinking to the world outside of academia, concentrating on personal and professional aspects. This is a good introduction to the subject, and many of the exercises could easily be adapted to a classroom setting.

Reasoning Across the Curriculum Program at Prince George's Community College. 15 Aug. 2007 <<http://academic.pgcc.edu/~wpeirce/MCCCTR/index.html>>.

Maintained by William Peirce, this site is a good resource for all aspects of teaching critical thinking, from developing rubrics to forming metacognitive strategies. This would be very helpful for new faculty and adjuncts who may not be able to attend inservice sessions.

Robinson, Carole, and Peter Kakela. "Creating a Space to Learn: A Classroom of Fun, Interaction, and Trust." *College Teaching* 54 (2006): 202-206.

A description of an introductory environmental studies course that uses many active learning techniques (reflection papers, case presentations, book reviews), this would be a useful article for new faculty to see how these techniques have been successfully employed in a college class.

Rudd, James A., Thomas J. Greenbowe, and Brian Hand. "Recrafting the General Chemistry Laboratory Report." *Journal of College Science Teaching* 31.4 (Dec. 2001/Jan. 2002): 230-234.

This article suggests a new approach to teaching chemistry laboratory experiments. It is quite common for labs to require students to follow set procedures and write a standard lab report containing title, purpose, procedure, date, calculations, results, and discussion. The authors suggest that this type of lab does not help students use critical thinking skills or make connections with real-life experiments and what is taught in a chemistry course. A modified science writing heuristic (SWH) is suggested and explained. This consists of beginning ideas and questions, tests and procedures, observations, claims, evidence, reading, and discussion. The experiments do not have to be changed, just the approach to how they are taught and the requirements from the students. The students become more actively engaged in explaining the experiments.

Sandstrom, Susan. "Use of Case Studies to Teach Diabetes and Other Chronic Illnesses to Nursing Students." *Journal of Nursing Education* 45.6 (2006): 229-232.

Although based on a nursing assignment, this article presents a good overview of the case study method, which is used, in this case, to develop student nurses' critical thinking skills, clinical ability, knowledge, and confidence. The case study method forces students to see the sorts of constant questions and decisions that both a diabetes patient and his or her caregiver must process. The article shows good examples of the case studies used. Furthermore, Susan Sandstrom notes that assigning case studies is not enough; the instructor must model problem solving and provide encouragement for students to participate.

Schamber, Jon, and Sandra Mahoney. "Assessing and Improving the Quality of Group Critical Thinking Exhibited in the Final Projects of Collaborative Learning Groups." *JGE: The Journal of General Education* 55 (2006): 103-37.

The authors studied critical thinking skills in a group of first-year students taking a general education course that assigns a group paper. They found two instructional techniques that improve students' critical thinking: revision and using a rubric.

Simpson, Katherine P. "Collaboration and Critical Thinking in Online English Courses." *Teaching English in the Two-Year College* 33 (2006): 421-29.

Katherine P. Simpson reports on her success in developing students' writing, research, and critical thinking skills in an online composition course by using peer tutors, synchronous discussions, and real-time research tutorials.

Solon, Tom. "Generic Critical Thinking Infusion and Course Content Learning in Introductory Psychology." *Journal of Instructional Psychology* 34.2 (2007): 95-109.

In a study of two introductory psychology courses, Tom Solon found that 10 hours of critical thinking instruction combined with approximately 20 hours of outside assignments had a significant effect on students' scores on a critical thinking instrument. The students' responses on written work were also significantly better than the control group's. Solon concludes that critical thinking gains in content-area classes can come from a relatively small time of direct instruction and active learning techniques.

Stevens, Danielle, and Antonia Levi. *Introduction to Rubrics: An Assessment Tool to Save Grading Time, Convey Effective Feedback and Promote Student Learning.* Sterling: Stylus, 2005.

The research repeatedly mentions rubrics as an effective way to assess and teach critical thinking in the classroom. Danielle Stevens and Antonia Levi show the why and how of rubric development. They also provide many examples that faculty will find helpful in developing their own.

***Teaching Critical Thinking*. 12 July 2005. 15 Aug. 2007 <<www.dartmouth.edu/~writing/materials/faculty/pedagogies/thinking.shtml>>.**

This concise two-page document from Dartmouth describes critical thinking and shows how one professor reinforces thinking skills in his psychology class.

Terenzini, Patrick, et al. "Influences Affecting the Development of Students' Critical Thinking Skills." Paper presented at the Association for Institutional Research. New Orleans. 1993. ERIC: ED372666.

This study examines the influence of curricular and out-of-class experiences on the growth in critical thinking of college freshmen. Both have a significant impact. Three factors have a statistically significant impact:

1. The level of parents' education
2. The number of hours spent studying
3. The number of non-assigned books read

The authors conclude, "Academic and student affairs units have common goals, and the evidence of this study suggests that students are more likely to benefit educationally if these units work together, rather than separately, in pursuit of these common goals."

Tice, Elizabeth. "What Is Critical Thinking?" *Handbook II: Advanced Teaching Strategies for Adjunct and Part-Time Faculty.* Ed. Donald Greive. Elyria: Info-Tec. 2000: 47-53.

Elizabeth Tice notes the multitude of definitions of critical thinking and that most have three ideas in common:

1. The need for a foundation in formal and informal logic

2. The willingness to ask questions
3. The ability to see answers even when clashing with preexisting beliefs

Tice cites an excellent example she uses in her classes, the fairy tale "Jack and the Beanstalk." She asks who is the hero. Everyone answers that Jack is. Then the class analyzes what Jack does in the story: disobeying his mother, trespassing, stealing, and murdering the Giant. She then asks who decided that Jack was the hero, and the class discusses cultural assumptions.

Tishman, Shari, and Albert Andrade. *Critical Squares: Games of Critical Thinking and Understanding.* Englewood: Colorado Libraries Unlimited, 1997.

While obviously oriented for K-12 teachers, many of these activities, modified a little, would be useful at the college level. The block and bingo games force students to examine possible causes and effects, as well as looking at connections between ideas and monitoring their own thinking. Also, this is a useful book for students who are learning how to become teachers.

Tsui, Lisa. "Courses and Instruction Affecting Critical Thinking." *Research in Higher Education* 40 (1999): 185-200.

Lisa Tsui notes that many studies aimed at measuring critical thinking have mixed results. This study involved analysis of self-reports of freshmen from the Cooperative Institutional Research Program 1989 Follow-Up Survey. This included 24,837 students from 392 four-year colleges nationwide. The focus was on types of courses and instructional techniques. The study found that only two types of courses did not positively correlate with growth in critical thinking: remedial/developmental courses and reading/study skills courses. Instructional techniques that positively affected students' perceptions of growth in critical thinking skills include giving a class presentation, working on a group project, taking an essay exam, working on an independent research project, and having a paper critiqued by an instructor. The only method with a negative impact was taking a multiple-choice exam. Tsui notes, however, that not one of the positive correlations was as strong as expected.

---. "Fostering Critical Thinking Through Effective Pedagogy: Evidence From Four Institutional Case Studies." *Journal of Higher Education* 73 (2002): 740-64.

After observing classes and conducting interviews at four colleges, Lisa Tsui found two instructional techniques that seem to correlate with critical thinking skills: writing assignments and class discussions. For writing assignments, revision and assignments that require analysis, evaluation, and synthesis seem to be most effective. For class discussion, Tsui says faculty will have to give up some lecture time and focus more on the depth and breadth of subject matter. She makes the pertinent observation that "widespread efforts to heighten students' critical thinking through instructional change are more likely to come about if they involve altering commonplace teaching techniques rather than radically replacing them."

van Gelder, Tim. "Teaching Critical Thinking: Some Lessons from Cognitive Science." *College Teaching* 53 (2005): 41-46.

Tim van Gelder summarizes six insights that those developing critical thinking programs should keep in mind:

- Critical thinking is difficult.
- To learn critical thinking, one must engage in the practice of critical thinking.
- Students must practice the transfer of critical thinking skills from one situation to another.
- Students must learn the theoretical underpinnings, as well as the practical application of critical thinking.
- It helps to present critical thinking arguments visually.
- Critical thinkers must fight against belief preservation.

VanWynsberghe, Robert, and Marc Cassivi. "Critical Thinking in the Introductory Sociology Classroom: Some Teaching Techniques." *Academic Exchange Quarterly* 4 (2000): 124-29.

The authors first present several descriptions of critical thinking ranging from references to "gaining skills engendered by an intellectual orientation that challenges faulty premises about the social world" to "asking why we see 'others' as different from and less desirable than ourselves." The means to achieving critical thinking is to use the concepts of sociology to evaluate one's place and actions in the world. An imaginary matrix correlates growth in critical thinking with acquisition of sociological knowledge– "social theorizing," to be exact. Three activities or techniques are used:

1. Student-Authored Autobiographies: Students produce a major paper in two parts. The first part is a description of some activity the student has been involved in. Examples are job, hobby, pastime, or sport in high school. The second section asks that the student find and relate an outside sociological study to their activity. The goal of the assignment is to have the student place his or her individual choices and behaviors within a broader social context.
2. Cognitive Mapping: Students make brief presentations to the class about some element of the course material. The goal is to have students relate sociological concepts to the everyday world.
3. Weekly Reviews: Students write papers of one or two pages addressing questions and issues raised in the course. It seems that this activity has to do with what is known as the sociology of knowledge in the broad sense and the perspective known as symbolic interactionism in a more narrow sense. The authors refer to it as "phenomenology, an approach/theory in sociology that focuses on the everyday world and how it is constructed according to shared meanings."

Verhovsek, Ester, and Thomas Striplin. "Problem-Based Learning: Applications for College Mathematics and Allied Health." ***Mathematics and Computer Education*** **37 (2003): 381-387.**

This article discusses a grant-sponsored program at the authors' college. This program teamed up developmental mathematics instructors and professors in the allied health programs. First, instructors from both programs sat in on each others' classes to get a sense of what math was required for the degrees. They then worked together to come up with a series of math problems related to health fields that they made as a supplemental math text for the courses. These real-world problems were often solved in teams, as well. The students in the PBL sections scored better than their peers on a post-test exam and also rated their teamwork skills as improved.

Visser, Lya, Yusra Laila Visser, and Charles Schlosser. "Critical Thinking in Distance Education and Traditional Education." ***The Quarterly Review of Distance Education*** **4 (2003): 400-407.**

The question of whether or not instructors in 66 California universities were helping students become critical thinkers was addressed in a 1997 research study. The researchers concluded that while 90 percent of the instructors said that critical thinking was a primary objective of their teaching, only 19 percent could formulate an adequate definition of critical thinking. Also, the inherent culture of many colleges tends to make students creatures of an environment that rewards producing the "right answer." College students' past educational experiences failed to produce critical thinking skills, and the traditional college classroom is not structured to produce these skills either. Many of the problems of the traditional classroom are passed to the distance education programs. Such problems include lack of creativity, a lock-step curriculum, little emphasis placed on reasoning, impact of language, and transmission of content rather than learning. Distance education courses are fertile ground for critical thinking processes through activities such as case studies, mock trials, and posted arguments. Distance education courses more easily foster critical thinking because of the participation in online discussion boards, interactive technologies, and improved access to resources. Also, the distance learners tend to bring more "real-world" experience that nurtures an environment of critical thinking.

Walsh, Catherine, and Lisa Seldomridge. "Critical Thinking: Back to Square Two." ***Journal of Nursing Education*** **45.6 (2006): 212-219.**

While geared toward nursing programs, this article is useful to any program that is thinking about incorporating critical thinking into its curriculum. First, the authors review the literature on standardized assessments of critical thinking, noting that findings have been inconsistent. Second, they review instructional strategies, finding a positive correlation between the level of teacher questioning and students' critical thinking ability. Their research shows that teacher questioning levels are uniformly low. This article's purpose, however, was to focus on three questions:

1. What type of thinking is reinforced in the classroom setting? They found in nursing the lecture is still the predominant mode of teaching, which does not reinforce critical thinking. To ameliorate that somewhat, many instructors assign a paper. But since usually only one is assigned, students have little chance to build on feedback.
2. What are the consequences of classroom technology on critical thinking? The authors have a surprising assertion here: that presentation software is actually inhibiting critical thinking by students since students are no longer responsible for selecting and organizing material.
3. What type of thinking is reinforced in clinical settings? They note that students often do little more than follow staff members' directions.

The authors finish with four recommendations for nursing programs:

1. Choose relevant critical thinking skills to foster and measure.
2. Promote thinking in the classroom.
3. Use classroom technology judiciously.
4. Promote thinking in clinical settings.

Weiss, Reneé E. "Designing Problems to Promote Higher-Order Thinking." ***New Directions in Teaching and Learning*** **95 (Fall 2003): 25-31.**

Here, Reneé E. Weiss notes that simply assigning problems is not enough to instill critical thinking. If problems are simple with a well-defined solution, students will not have to use higher order thinking skills to solve them. Weiss then goes through the characteristics of a well-formed problem:

- There should be a clear purpose for the problem.
- It should be appropriate to the students' content current content knowledge.
- It should be ill-structured and authentic, relating to the students' current or future needs.
- It should also be collaborative, with students having to come together to synthesize ideas.
- It should lead to lifelong and self-directed learning.

Weiss provides examples and explains how they are conducive to higher order thinking.

Williams, Robert, et al. "Psychological Critical Thinking As a Course Predictor and Outcome Variable." ***Teaching of Psychology*** **30 (2003): 220-223.**

Robert Williams and his associates conducted a study of critical thinking learning in a large human development class. What was especially interesting is that they maintained the current structure of the course and added a critical thinking component. They placed multiple choice critical thinking questions on their practice examinations and then discussed them in class. Students were given both a pre- and a post-test critical thinking assessment. In general, the scores went up. There was also a positive correlation between the critical thinking scores and the grades in the class. One caution:

The researchers warn that "low-performing students may be unlikely to improve their critical thinking in content courses, even with treatments specially designed to promote critical thinking."

---, and Susan Stockdale. "High-Performing Students With Low Critical Thinking Skills." *JGE: Journal of General Education* 52(2003): 200-226.

The authors note that poor critical thinkers are doubly disadvantaged in the college classroom: They are less likely to make good grades and to improve their already weak critical thinking skills. But in most classes, there are some poor critical thinkers who do well. The authors investigated to see what, if any, were common characteristics among those specific students. After analyzing data from a human development course for six semesters, the authors concluded that the low critical thinkers who performed well in the course had better work habits. The key distinguishing study habit seemed to be notetaking. These students also made modest gains in the post-test critical thinking assessments. Still, "the probability of making an A averaged 8 times higher in the highest critical thinking group than in the lowest critical thinking groups."

WolcottLynch. 11 Feb. 2006. 15 Aug. 2007 <<www.wolcottlynch.com/>>.

As stated on the website, the company's mission is to "conduct research, offer consulting services, and develop innovative and practical educational resources for enhancing and assessing critical thinking, professional problem solving, and other higher-order thinking skills." The site contains many exceptional materials for colleges and instructors hoping to incorporate critical thinking into their classrooms.

Wolcott, Susan. *College Faculty Handbook: Steps for Better Thinking: A Classroom Model for Teaching, Learning, and Assessing Higher-Order Thinking Skills.* Draft: Jan. 2006. 15 Aug. 2007 <<www.WolcottLynch.com>>.

This very useful handbook breaks down the developmental levels of critical thinking in college students and offers a model for helping students through the various stages to become higher order thinkers.

Woodford, Paul. "Developing Critical Thinkers in Music." *Music Educators Journal* 83.1 (1996): 27-32.

Paul Woodford discusses the arguments for and against the validity and usefulness of teaching critical thinking skills in music classes. He provides a how-to for fostering critical thinking skills in students and empowering them to control the growth and constant change of their musical education and experience. Other topics discussed include types of thinking skills, developing individuality based on social norms and beliefs, teaching critical thinking skills in music classes, and examples of classroom scenarios.

Yang, Ya-Ting, Timothy Newby, and Robert Bill. "Using Socratic Questioning to Promote Critical Thinking Skills Through Asynchronous Discussion Forums in Distance Education Environments." *American Journal of Distance Education* 19 (2005): 163-181.

In this small study of 16 undergraduate students taking a distance course, Ya-Ting Yang and associates found that modeling, teaching, and participating in Socratic questioning resulted in students demonstrating higher levels of critical thinking and retaining those skills for a longer time. Critical thinking skills were measured by the California Critical Thinking Skills Test. It is important to note that the instructors modeled the type of thinking and responses required.

Yoder, Janice, and Catherine Hochevar. "Encouraging Active Learning Can Improve Students' Performance on Exams." *Teaching of Psychology* 32 (2005): 91-95.

Over three years in a psychology of women class, the authors found that students performed better on test items that were presented through active learning techniques compared to lecture, autonomous readings, or video without discussion.