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#### Reference List on Scientific Thinking: expertise and teaching & learning

## Analogies and models

- 1. Arizona State U. 2009. Model Instruction Research. June 8. http://modeling.asu.edu/R&E/Research.html.
- 2. Brewe, Eric. 2008. "Modeling theory applied: Modeling Instruction in introductory physics." *American Journal of Physics* 76 (12): 1155. doi:10.1119/1.2983148.
- Gentner, D. 2001. Mental Models, Psychology of. In *International Encyclopedia of the Social & Behavioral Sciences*, 9683-9687. Oxford: Pergamon. http://www.sciencedirect.com/science/article/B7MRM-4MT09VJ-22C/2/d9264f7ba04fc42f868db423a41656cc.
- 4. Gick, M. L, and K. J Holyoak. 1983. "Schema induction and analogical transfer." *Cognitive psychology* 15 (1): 1–38.
- 5. Jee, B. D, D. H Uttal, D. Gentner, C. Manduca, T. F Shipley, B. Tikoff, C. J Ormand, and B. Sageman. 2010. "Commentary: Analogical Thinking in Geoscience Education." *Journal of Geoscience Education* 58 (1): 2–13.
- Johnson-Laird, P. N. 2001. Reasoning with Mental Models. In *International Encyclopedia of the Social & Behavioral Sciences*, 12821-12824. Oxford: Pergamon. http://www.sciencedirect.com/science/article/B7MRM-4MT09VJ-387/2/05a1ecd0008e2543c9c7bb29ec0e5a7d.
- 7. Lehrer, R., and L. Schauble. 2010. "What Kind of Explanation is a Model?" *Instructional explanations in the disciplines*: 9–22.
- 8. Lehrer, Richard, and Leona Schauble. 2006. Cultivating Model-based Reasoning in Science Education. In *Cambridge Handbook of the Learning Sciences*, 371-387. Cambridge University Press.

# **Argument and writing**

- 9. Kuhn, Deanna, Kalypso Iordanou, Maria Pease, and Clarice Wirkala. October. "Beyond control of variables: What needs to develop to achieve skilled scientific thinking?" *Cognitive Development* 23 (4): 435-451. doi:10.1016/j.cogdev.2008.09.006.
- 10. Sandoval, William, and Kelli Millwood. 2005. "The Quality of Students' Use of Evidence in Written Scientific Explanations." *Cognition and Instruction* 23 (1) (March): 23-55. doi:10.1207/s1532690xci2301\_2.

# **Problem Solving**

- 11. Adams, W. K, and C. E Wieman. 2007. Problem Solving Skill Evaluation Instrument-Validation Studies. In 2006 Physics Education Research Conference, 883:18–21.
- 12. Adams, Wendy Kristine. 2007. Development of a problem solving evaluation instrument; untangling of specific problem solving assets. *Ph.D. Thesis*. http://adsabs.harvard.edu/abs/2007PhDT......172A.
- 13. Malone, Kathy L. 2008. "Correlations among knowledge structures, force concept inventory, and problem-solving behaviors." *Physical Review Special Topics Physics Education Research* 4 (2) (November). doi:10.1103/PhysRevSTPER.4.020107. http://link.aps.org/doi/10.1103/PhysRevSTPER.4.020107.

## EARTH & OCEAN SCIENCES SCIENCE EDUCATION INITIATIVE

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#### Questioning

- 14. Barak, Miri, and Sheizaf Rafaeli. 2004. "On-line question-posing and peer-assessment as means for web-based knowledge sharing in learning." *International Journal of Human-Computer Studies* 61 (1) (July): 84-103. doi:10.1016/j.ijhcs.2003.12.005.
- 15. Chin, Christine, and David E. Brown. 2002. "Student-generated questions: A meaningful aspect of learning in science." *International Journal of Science Education* 24 (5): 521. doi:10.1080/09500690110095249.
- 16. Donham, Jean, Jill A. Heinrich, and Kerry A. Bostwick. 2009. "Mental Models of Research: Generating Authentic Questions." *College Teaching* 58 (8-14) (December): 32-37. doi:10.1080/87567550903252835.
- 17. Dori, Y. J., and O. Herscovitz. 1999. "Question-posing capability as an alternative evaluation method: Analysis of an environmental case study." *Journal of Research in Science Teaching* 36 (4): 411-430.
- 18. Harper, Kathleen A., Eugenia Etkina, and Yuhfen Lin. 2003. "Encouraging and analyzing student questions in a large physics course: Meaningful patterns for instructors." *Journal of Research in Science Teaching* 40 (8): 776-791. doi:10.1002/tea.10111.
- 19. Hofstein, Avi, Oshrit Navon, Mira Kipnis, and Rachel Mamlok-Naaman. 2005. "Developing students' ability to ask more and better questions resulting from inquiry-type chemistry laboratories." *Journal of Research in Science Teaching* 42 (7) (September): 791-806. doi:10.1002/tea.20072.
- 20. Marbach-Ad, G., and P. G. Sokolove. 2000. "Can undergraduate biology students learn to ask higher level questions?" *Journal of Research in Science Teaching* 37 (8).
- 21. Marbach-Ad, Gili, and Phillip G. Sokolove. 2000. "Good Science Begins with Good Questions: Answering the Need for High-Level Questions in Science." *Journal of College Science Teaching* 30 (3): 192-95.
- 22. Mestre, J. P. 2002. "Probing adults' conceptual understanding and transfer of learning via problem posing." *Journal of Applied Developmental Psychology* 23 (1): 9–50.

# Science expertise theory

- 23. Bransford, John D., Anne L. Brown, Rodney R. Cocking, and Committee on Developments in the Science of Learning, National Research Council, eds. 2000. *How People Learn: Brain, Mind, Experience, and School: Expanded Edition*. Washington, D.C.: The National Academies Press.
- 24. Dunbar, K. 2000. "How Scientists Think in the Real World Implications for Science Education." *Journal of Applied Developmental Psychology* 21 (1): 49–58.
- 25. ——. 2001. Scientific Reasoning and Discovery, Cognitive Psychology of. In *International Encyclopedia of the Social & Behavioral Sciences*, 13746-13749. Oxford: Pergamon. http://www.sciencedirect.com/science/article/B7MRM-4MT09VJ-38V/2/afb29a6feaffedca069b303098704807.
- 26. Ericsson, K. A. 2006. The influence of experience and deliberate practice on the development of superior expert performance. In *The Cambridge handbook of expertise and expert performance*, 683–703. Cambridge University Press.
- 27. Kuhn, Deanna, Kalypso Iordanou, Maria Pease, and Clarice Wirkala. October. "Beyond control of variables: What needs to develop to achieve skilled scientific thinking?" *Cognitive Development* 23 (4): 435-451. doi:10.1016/j.cogdev.2008.09.006.
- 28. Manduca, Cathryn A., and David W. Mogk. 2007. *Earth and Mind: How Geologists Think and Learn About the Earth*. Geological Society of Amer, March 30.

#### EARTH & OCEAN SCIENCES SCIENCE EDUCATION INITIATIVE

The University Of British Columbia



- 29. Windschitl, Mark. 2009. NSTA News Story. *Rethinking Scientific Inquiry*. November 4. http://www.nsta.org/publications/news/story.aspx?id=56675&print=true.
- 30. Zimmerman, C. 2000. "The development of scientific reasoning skills." *Developmental Review* 20 (1): 99–149.

## Science skills - pedagogy

- 31. Anon. Stanford Education Assessment Laboratory. http://www.stanford.edu/dept/SUSE/SEAL/.
- 32. Fencl, H. S. 2010. "Development of Students' Critical Reasoning Skills Through Content Focussed Activities in a General Education Course." *Journal of College Science Teaching* 39 (5): 7.
- 33. Paul, R., and L. Elder. CriticalThinking.org Home Page. http://www.criticalthinking.org/print-page.cfm?pageID=9.
- 34. Shavelson, R. J. The Collegiate Learning Assessment. In *Ford Policy Forum 2008: Forum for the Future of Higher Education*.
- 35. Steinberg, Richard, Sebastien Cormier, and Adiel Fernandez. 2009. "Probing student understanding of scientific thinking in the context of introductory astrophysics." *Physical Review Special Topics Physics Education Research* 5 (2) (September). doi:10.1103/PhysRevSTPER.5.020104. http://link.aps.org/doi/10.1103/PhysRevSTPER.5.020104.
- 36. White, B., M. Stains, M. Escriu-Sune, E. Medaglia, L. Rostamnjad, C. Chinn, and H. Sevian. 2011. "A Novel Instrument for Assessing Students' Critical Thinking Abilities." *Journal of College Science Teaching* 40 (5): 103 - 107.
- 37. Windschitl, Mark. 2004. "Folk theories of 'inquiry': How preservice teachers reproduce the discourse and practices of an atheoretical scientific method." *Journal of Research in Science Teaching* 41 (5) (May): 481-512. doi:10.1002/tea.20010.

#### Other

- 38. Chasteen, S. V, K. K Perkins, P. D Beale, S. J Pollock, and C. E Wieman. 2011. "A Thoughtful Approach to Instruction: Course transformation for the rest of us." *Journal of College Science Teaching* 40 (4): 70-76.
- 39. Duit, Reinders. 2009. Bibliography STCSE. *Bibliography STCSE*. December 2. http://www.ipn.uni-kiel.de/aktuell/stcse/stcse.html.
- 40. Simon, B., and J. Taylor. 2009. "What Value are Course-Specific Learning Goals?" *Journal of College Science Teaching* 39 (2): 52–57.
- 41. Wieman, Carl, Katherine Perkins, and Sarah Gilbert. 2010. "Transforming Science Education at Large Research Universities: A Case Study in Progress." *Change Magazine* March/April 2010 (March). http://www.changemag.org/Archives/Back%20Issues/March-April%202010/transforming-science-full.html.
- 42. Windschitl, M. 2004. What types of knowledge do teachers use to engage learners in "doing science"? Rethinking the continuum of preparation and professional development for secondary science educators. In *Meeting High School Science Laboratories: Role and Vision. Washington: National Academy of Sciences*.