K-12 Students

Classroom

1) **Bransford, J, Brown, A., and Cocking, R. (1999) *How People Learn: Brain, mind, experience, and school*. Washington, DC: National Academy Press.**

   Evidence from many branches of science has significantly added to our understanding of what it means to know, from the neural processes that occur during learning to the influence of culture on what people see and absorb. "How People Learn" examines these findings and their implications for what we teach, how we teach it, and how we assess what our children learn. The book uses exemplary teaching to illustrate how approaches based on what we now know result in in-depth learning. This new knowledge calls into question concepts and practices firmly entrenched in our current education system.

2) **Wiggins, G.P. and McTighe, J. (2005) _Understanding by Design_. Alexandria, VA: ASCD.**

   What is understanding and how does it differ from knowledge? How can we determine the big ideas worth understanding? Why is understanding an important teaching goal, and how do we know when students have attained it? How can we create a rigorous and engaging curriculum that focuses on understanding and leads to improved student performance in today's high-stakes, standards-based environment? Authors Grant Wiggins and Jay McTighe answer these and many other questions in this second edition of Understanding by Design.

3) **Borgman, C. L., Abelson, H., Dirks, L. Johnson, R., Koedinger, K. R., Linn, M. C., et al. (2008) *Fostering learning in the networked world: The cyberlearning opportunity and challenge, A 21st Century Agenda for the National Science Foundation* (Report of the NSF Task Force on Cyberlearning). Washington, D.C.: National Science Foundation** http://www.nsf.gov/pubs/2008/nsf08204/nsf08204.pdf

   The report identified five recommendations that cut across the strategies for growth and opportunities for action. These recommendations offer initial steps for the NSF to take while complementing existing work at NSF: a) help build a vibrant cyberlearning field by promoting cross-disciplinary communities of cyberlearning researchers and practitioners including technologists, educators, domain scientists, and social scientists; b) instill a "platform perspective"—shared, interoperable designs of hardware, software, and services—into NSF's cyberlearning activities; c) emphasize the transformative power of information and communications technology for learning, from K to grey; d) adopt programs and policies to promote open educational resources; and e) take responsibility for sustaining NSF-sponsored cyberlearning innovations.

4) **National Science Foundation. (2010, May) *Preparing the next generation of STEM innovators: Identifying and developing our nation's human capital.* (Publication No. NSB-10-33).** http://www.nsf.gov/nsb/publications/2010/nsb1033.pdf

   This report contains a series of policy actions, a research agenda, and three key recommendations detailing how our Nation might foster the identification and development of future STEM innovators: a) *Provide opportunities for excellence* - we must offer coordinated, proactive, sustained formal and informal interventions to develop their abilities. Students should learn at a pace, depth, and breadth commensurate with their talents and interests and in a fashion that elicits engagement, intellectual curiosity, and creative problem solving—essential skills for future innovation; b) *Cast a wide net* - develop and implement appropriate talent assessments at multiple grade levels and prepare educators to recognize potential, particularly among those individuals who have not been given adequate opportunities to transform their potential into academic achievement; and c) *Foster a supportive ecosystem* - parents/guardians, education professionals, peers, and students themselves must work together to create a culture that expects excellence, encourages creativity, and rewards the successes of all students regardless of their race/ethnicity, gender, socioeconomic status, or geographical locale.

5) **Partnership for 21st Century Skills. (2009, December) *P21 Framework Definitions*.** http://www.p21.org/documents/P21_Framework_Definitions.pdf

To help practitioners integrate skills into the teaching of core academic subjects, the Partnership developed a unified, collective vision for learning known as the Framework for 21st Century Learning. This Framework describes the skills, knowledge and expertise students must master to succeed in work and life; it is a blend of content knowledge, specific skills, expertise and literacies.

6) **National Research Council. (2011) *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas.* Committee on a Conceptual Framework for New K-12 Science Education Standards. Board on Science Education, Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academies Press.**
http://www7.nationalacademies.org/bose/Standards_Framework_Homepage.html

A Framework for K-12 Science Education Standards represents the first step in a process to create new standards in K-12 science education. The framework highlights the power of integrating understanding the ideas of science with engagement in the practices of science and is designed to build students' proficiency and appreciation for science over multiple years of school.

7) **President's Council of Advisors on Science and Technology. (2010) *Prepare and Inspire: K-12 Education in Science, Technology, Engineering, and Math (STEM) for America's Future*.** http://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast-stem-ed-final.pdf

A report outlining the need to improve STEM education through better preparation and inspiring students, and increase the federal government's strategy for improving K-12 STEM education.

8) **Committee on Science, Engineering & Public Policy (2007) *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future*. Washington, D. C.: National Academies Press.**
http://www.nap.edu/catalog.php?record_id=11463

In a world where advanced knowledge is widespread and low-cost labor is readily available, U.S. advantages in the marketplace and in science and technology have begun to erode. A comprehensive and coordinated federal effort is urgently needed to bolster U.S. competitiveness and pre-eminence in these areas. This congressionally requested report by a pre-eminent committee makes four recommendations along with 20 implementation actions that federal policy-makers should take to create high-quality jobs and focus new science and technology efforts on meeting the nation's needs: a) Increase America's talent pool by vastly improving K-12 mathematics and science education; b) Sustain and strengthen the nation's commitment to long-term basic research; c) Develop, recruit, and retain top students, scientists, and engineers from both the U.S. and abroad; and d) Ensure that the United States is the premier place in the world for innovation.

9) **National Research Council (2007), *Taking Science to School: Learning and Teaching Science in Grades K-8*. Washington, DC: National Academy Press.**
http://www.nap.edu/catalog.php?record_id=11625

What is science for a child? How do children learn about science and how to do science? Drawing on a vast array of work from neuroscience to classroom observation, *Taking Science to School* provides a comprehensive picture of what we know about teaching and learning science from kindergarten through eighth grade. By looking at a broad range of questions, this book provides a basic foundation for guiding science teaching and supporting students in their learning. The book also provides a detailed examination of how we know what we know about children's learning of science, including the role of research and evidence. *Taking Science to School* answers such questions as:

* When do children begin to learn about science? Are there critical stages in a child's development of such scientific concepts as mass or animate objects?
* What role does nonschool learning play in children's knowledge of science?
* How can science education capitalize on children's natural curiosity?
* What are the best tasks for books, lectures, and hands-on learning?
* How can teachers be taught to teach science?

10) **Brown, J.S. & Adler, R.P. (2008). "Minds on fire: Open education, the long tail, and learning 2.0." *Educause Review,* 43(1).**
http://net.educause.edu/ir/library/pdf/ERM0811.pdf

This document focuses on social learning in virtual environments and peer to peer learning through these environments. The authors emphasize the importance of forming a community of practice so that students can learn the "practices and the norms of established practitioners in that field". Also, this article stresses inquiry in terms of a "demand-pull" model instead of the "traditional supply-push" mode of building up an inventory of knowledge in students' heads." They also mention virtual networking between students and scientists. Finally, the article discusses examples of how scientists have answered student questions using their scientific equipment (i.e. running bugs sent in by the public through an SEM).