Digital Resources for

The STEM Shift: A Guide for School Leaders

by Ann Myers and Jill Berkowicz

Part I. Why STEM?

[for updates to this Resource list, please visit http://bit.ly/TheSTEMShift]

Chapter 1. The Tipping Point

Center for Public Education. (2009). *21st Century Skills*: http://www.centerforpubliceducation.org/Main-Menu/Policies/21st-Century/21st-century-demographics-21st-century-skills-.html

Center for Public Education. (2009). *Defining a 21st Century Education*: http://www.centerforpubliceducation.org/Main-Menu/Policies/21st-Century/Defining-a-21st-Century-Education-Full-report-PDF.pdf

Center for Public Education. (2012). *The United States of Education: The Changing Demographics of the United States and Their Schools*: http://www.centerforpubliceducation.org/You-May-Also-Be-Interested-In-landing-page-level/Organizing-a-School-YMABI/The-United-States-of-education-The-changing-demographics-of-the-United-States-and-their-schools.html

Federal Reserve Bank of Dallas. (2013). *Immigrants in the U.S. Labor Market*: http://www.dallasfed.org/assets/documents/research/papers/2013/wp1306.pdf

Forbes. (n.d.). *Top 10 Companies Hiring Foreign Workers, No. 4 IBM*: http://www.forbes.com/pictures/efei45mdli/no-4-ibm/

Gould, S. J., & Eldredge, N. (2013). *Niles Eldredge–Stephen Jay Gould in the 1960s and 1970s, and the Origin of "Punctuated Equilibria"*: http://yhoo.it/1IEAKTt

Information Technology Industry Council, Partnership for a New American Economy, & U.S. Chamber of Commerce. (2012). *Help Wanted: The Role of Foreign Workers in the Innovation Economy* (Report on foreign workers in STEM): http://www.renewoureconomy.org/sites/all/themes/pnae/stem-report.pdf

Kids Count Data Center (U.S. demographic information on children): http://datacenter.kidscount.org/data/tables/103-child-population-by-

race?loc=1&loct=1#detailed/1/any/false/36,868,867,133,38/66,67,68,69,70,71,12,72/423,424

Ryan, C. L., & Siebens, J. (2012). *Educational Attainment in the United States: 2009* (Report P20-566): http://www.census.gov/prod/2012pubs/p20-566.pdf

Wulf, W. A., Kouzes, R. T., & Myers, J. T. (1996). *Collaboratories: Doing Science on the Internet*: https://www.cs.virginia.edu/people/faculty/pdfs/Collaboratories.pdf

Chapter 2. The 21st Century Learning Environment

Carnegie Mellon University. *Alice: Teaching Programming Through 3D Animation and Storytelling* (object-oriented, 3D programming environment): http://www.cmu.edu/corporate/news/2007/features/alice.shtml (QR code on page 21)

EdSurge News. (2013). *Learn to Code, Code to Learn*: https://www.edsurge.com/n/2013-05-08-learn-to-code-code-to-learn

11-Year-Old Girl Uses Science Project to Create Prosthetic Hands for Children. (2014). (Sierra Petrocelli builds a prosthetic hand): http://kdvr.com/2014/07/15/11-year-old-girl-uses-science-project-to-create-prosthetic-hands-for-children/

McNulty, R. J. (2011). *Best Practices to Next Practices: A New Way of "Doing Business" for School Transformation*: http://teacher.scholastic.com/products/scholastic-achievement-partners/downloads/Best_Practices_To_Next_Practices.pdf

Neal, J. (n.d.). *Edgewalkers*: http://edgewalkers.org

Overmyer, J. *Flipped Learning Network:* http://www.flippedclassroom.com

Partnership for 21st Century Skills (P21). *Framework for 21st Century Learning*: http://www.p21.org/our-work/p21-framework

Scratch (programming for ages 8 to 12): http://scratch.mit.edu (QR code on page 21)

ScratchJr (programming for ages 5 to 7): http://www.scratchjr.org

Simon, J. (2014). *E-Nabling Sierra*: http://www.3duniverse.org/2014/05/16/e-nabling-sierra/Teach LivE (the mixed reality tool used to help teachers and leaders improve interactions with students and adults): http://teachlive.org (QR code on page 22)

Te@chThought: 21st Century Pedagogy: http://www.teachthought.com/technology/a-diagram-of-21st-century-pedagogy/#respond

Wakin, D. J. (2010): *The Valhalla Machine*:
http://www.nytimes.com/2010/09/19/arts/music/19ring.html?pagewanted=all&_r=0

What Is STEM? (video): http://youtu.be/AlPJ48simtE

Chapter 3. Clearing the Path

Alter, C. (2014). *Soon There Will Be Female Scientist LEGOs*: http://time.com/2822921/soon-there-will-be-female-scientist-legos/

Finley, K. (2014). *In a First, Women Outnumber Men in Berkeley Computer Science Course*: http://www.wired.com/2014/02/berkeley-women/

Rhodan, M. (2013). *These Are the 30 People Under 30 Changing the World* (article highlighting Britney Wenger): http://ideas.time.com/2013/12/06/these-are-the-30-people-under-30-changing-the-world/slide/britney-wenger/

STEM Integration in K–12 Education (video): http://youtu.be/AlPJ48simtE (QR code on page 32)

ThinkProgress.org. (2014). *Women Are Leaving Science and Engineering Jobs in Droves* (women leaving STEM jobs): http://thinkprogress.org/economy/2014/02/13/3287861/women-leaving-stem-jobs/

Voyer, D., & Voyer, S. D. (2014). *Gender Differences in Scholastic Achievement: A Meta-Analysis*: http://dx.doi.org/10.1037/a0036620

Chapter 4. The Achievement Gap

Brown, T. *Design Thinking: Thoughts by Tim Brown* (Web log): http://designthinking.ideo.com/?p=1165

Institute for Inquiry. (1991). *Constructivist Learning Theory*: http://www.exploratorium.edu/ifi/resources/constructivistlearning.html

Chapter 5. Special Populations

Centers for Disease Control. (2014). *CDC Estimates 1 in 68 Children Has Been Identified With Autism Spectrum Disorder:* http://www.cdc.gov/media/releases/2014/p0327-autism-spectrum-disorder.html

Johnson, L. B. (1964). *91st Annual Message to the Congress on the State of the Union* (January 8, 1964): http://www.presidency.ucsb.edu/ws/?pid=26787

Kids Count Data. (2014). *Child Population by Race*: http://datacenter.kidscount.org/data/tables/103-child-population-by-race?loc=1&loct=1#detailed/1/any/false/36,868,867,133,38/66,67,68,69,70,71,12,72/423,424

Lombardi, J. (2004). *Practical Ways Brain-Based Research Applies to ESL Learners* (ESL learning research): http://iteslj.org/Articles/Lombardi-BrainResearch

National Center for Education Statistics. (n.d.). *Fast Facts: English Language Learners.*

U.S. Department of Education, Institute of Education Sciences: https://nces.ed.gov/fastfacts/display.asp?id=96

Short, D. J., & Fitzsimmons, S. (2007). *Double the Work: Challenges and Solutions to Acquiring Language and Academic Literacy for Adolescent English Language Learners:* http://carnegie.org/fileadmin/Media/Publications/PDF/DoubletheWork.pdf

STEM Smartbrief: Raising the Bar: Increasing Achievement for All Students: http://successfulstemeducation.org/resources/raising-bar-increasing-stem-achievement-all-students

U.S. Department of Education. (2007). *History: Twenty-Five Years of Progress in Educating Children With Disabilities Through IDEA:* http://www2.ed.gov/policy/speced/leg/idea/history.html

U.S. Department of Education, Office of Special Education Programs. (n.d.). *Building the Legacy: IDEA 2004*: http://idea.ed.gov/explore/view/p/,root,dynamic,TopicalBrief,23

U.S. Department of Education, Office of Special Education Programs, IDEA: http://idea.ed.gov/explore/home

Wei, X., Yu, J. W., Shattuck, P., McCracken, M., & Blackorby, J. (2013). *Science, Technology, Engineering, and Mathematics (STEM) Participation Among College Students With an Autism Spectrum Disorder*: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3620841/

Part II. Shifting

Chapter 6. The Shift Begins Within a Leader

Moyers, B. (2008). *Democracy in America Is a Series of Narrow Escapes, and We May Be Running Out of Luck*: http://www.alternet.org/story/85521/moyers%3A_%27democracy_in_america_is_a_series_of_narrow_escapes%2C_and_we_may_be_running_out_of_luck%27

Chapter 7. Entering the STEM Shift

Battelle. *STEM Education: Growing Tomorrow's Innovators in Science, Technology, Engineering and Math*: http://www.battelle.org/our-work/stem-education

Teaching Institute for Excellence in STEM (TIES): http://www.tiesteach.org

Chapter 8. Planning the Shift

Arizona STEM Network. (2013). *The STEM Immersion Guide for Schools and Districts*: http://stemguide.sfaz.org/wp-content/uploads/2015/01/SFAz_STEM_ImmersionGuide1214.pdf

Delaney, M. (2014). *7 Guidelines for Building a STEAM Program*: http://www.edtechmagazine.com/k12/article/2014/04/7-guidelines-building-steam-program

East Syracuse Minoa Central School District. *Strategic Plan*: http://www.esmschools.org/district.cfm?subpage=24324 (QR code on page 75)

Gollwitzer, P. (1999). Implementation intentions: Strong effects of simple plans. *American Psychologist, 54,* 493–503 (research on preparing for obstacles before they arise): http://www.psychology.nottingham.ac.uk/staff/msh/mh_teaching_site_files/teaching_pdfs/C83SPE_lecture3/Gollwitzer%20(1999).pdf

Goochland County Schools. *G21: A Framework for Developing Twenty-First Century Skills and Deeper Learning Experiences*: http://www.glnd.k12.va.us/index/resource/g21/ (QR code on page 83)

Goochland County Schools. *Strategic Plan*: http://www.glnd.k12.va.us/index/schoolboard/plan (QR code on page 83)

Granite School District Five-Year Framework: http://www.graniteschools.org/teachinglearning/wp-content/uploads/sites/13/2014/11/GSD-5-Year-Plan.pdf (QR code on page 78)

Chapter 9. STEM Curriculum Shifting

Buck Institute for Education (BIE). *Project Search* **(for curated project-based learning examples):** http://bie.org/project_search/results/search/P450

Eesha Khare Inventing the One Minute Mobile Phone Charger: https://www.youtube.com/watch?v=kMWWOnnS3ZM (QR code on page 102)

Mayo, G. (2014). *Creating Architectural Models of Literary Themes* **(reader idea; Montgomery Blair High School English Class):** http://learning.blogs.nytimes.com/2014/05/15/reader-idea-creating-architectural-models-of-literary-themes/

Montgomery County Public Schools. *Vision, Mission, and Core Values*: http://www.montgomeryschoolsmd.org/boe/about/mission.aspx

New Milford High School. *Program of Studies 2014–2015 Academic Season*: http://www.newmilfordschools.org/NMHS/media/Course_of_Study_2014-15.pdf

Pericoli, M. (2013). *Writers as Architects*: http://opinionator.blogs.nytimes.com/2013/08/03/writers-as-architects/

President Obama Speaks at the 2014 White House Science Fair **(video):** http://youtu.be/vke-SE1mqls (QR code on page 103)

Project Lead the Way: https://www.pltw.org

Project Lead the Way. (2014). *The Louis Calder Foundation Puts Support Behind Elementary STEM Education*: https://www.pltw.org/news/items/201405-louis-calder-foundation-puts-support-behind-elementary-stem-education

Stratford High School Profile. http://www.mnps.org/pages/mnps/About_Us/MNPS_Schools/High_Schools/High_School_Profile/Stratford_High_School_Profile (QR code on page 97)

Stratford STEM Magnet High School **(video with Principal Michael Steele)** http://youtu.be/4bWFb9vjEXE (QR code on page 96)

The Virginia Initiative for Science Teaching and Achievement (VISTA). *What Is VISTA? A Program Overview* **(video):** http://youtu.be/5M3n3VIfyog

Chapter 10. Developing Capacity: STEM-Centric Professional Development

Buck Institute for Education (BIE). *Project Search* (for curated project-based learning examples): http://bie.org/project_search/results/search/P450 (QR code on page 112)

Charlotte-Mecklenburg Schools. *Strategic Plan 2018*: http://www.cms.k12.nc.us/mediaroom/strategicplan2018/Documents/Strategic%20Plan%202018%20For%20a%20Better%20Tomorrow%20Fact%20Sheet.pdf (QR code on page 115)

DuPont Hadley Middle School: http://duponthadleyms.mnps.org/pages/DuPont_Hadley_Middle_School

Middle Tennessee STEM Hub: http://midtnstem.com

National Education Association. *The 10 Best STEM Resources Science, Technology, Engineering & Mathematics Resources for PreK–12*: http://www.nea.org/tools/lessons/stem-resources.html

Project LIFT. *About Project L.I.F.T.* (public/private partnership nonprofit organization, operating as one of five learning communities in the Charlotte-Mecklenburg School System): http://www.projectliftcharlotte.org/about

Public Impact (Helping education leaders and policymakersimprove student learning in K–12 education). *About Public Impact*: http://publicimpact.com/about-public-impact/

Tennessee Department of Education. (2014). *First to the Top*: http://www.tn.gov/education/about/fttt.shtml

The Tennessee Higher Education Commission and Battelle Memorial Institute. *Battelle Memorial Institute* (video): http://youtu.be/8PckHDH_6Ho (QR code on page 111)

The Virginia Initiative for Science Teaching and Achievement (VISTA): http://vista.gmu.edu (QR code on page 116)

The Virginia Initiative for Science Teaching and Achievement (VISTA). *VISTA Voices* (videos): https://www.youtube.com/user/VISTAScience?feature=watch (QR code on page 116)

The Virginia Initiative for Science Teaching and Achievement (VISTA). *What Is VISTA? A Program Overview*: http://youtu.be/5M3n3Vlfyog (QR code on page 116)

Chapter 12. STEM Collaborations and Trust

Center for Courage & Renewal. *Circle of Trust Touchstones*:
http://www.couragerenewal.org/wpccr/wp-content/uploads/touchstones-poster.pdf
(QR code on page 136)

Chapter 13. A Call to Action

Columbia University School of the Arts. *The Laboratory of Literary Architecture: A Workshop With Matteo Pericoli* (literary architecture lab at Columbia University): http://arts.columbia.edu/laboratory-literary-architecture-workshop-matteo-pericoli

EdSurge (for science and technology news and updates): https://www.edsurge.com

Edutopia (sharing evidence- and practitioner-based learning strategies that empower you to improve K–12 education): http://www.edutopia.org

edWeb: A professional online community for educators: http://home.edweb.net

Freeman, S., Eddy, S. L., McDonough, M., Smith, M. K., Okoroafor, N., Jordt, H., & Wenderoth, M. P. (2014). Active learning increases student performance in science, engineering, and mathematics. *Proceedings of the National Academy of Sciences of the United States of America, 111,* **8410–8415 (meta-analysis about effect of lecture on learning):** http://iteachem.net/wp-content/uploads/2014/05/Freeman-S-Proc-Natl-Acad-Sci-USA-2014-Active-learning-increases-student-performance-in-science-engineering-and-mathematics.pdf

Mayo, G. (2014). *Creating Architectural Models of Literary Themes* **(reader idea; Montgomery Blair High School English Class):** http://learning.blogs.nytimes.com/2014/05/15/reader-idea-creating-architectural-models-of-literary-themes/

Mind/Shift (launched in 2010 by KQED and NPR; explores the future of learning in all its dimensions): http://blogs.kqed.org/mindshift/

The National Education Association. *The 10 Best STEM Resources: Science, Technology, Engineering & Mathematics Resources for PreK–12*: **STEM lesson resources:** http://www.nea.org/tools/lessons/stem-resources.html

STEMconnector (information about STEM): https://www.stemconnector.org

Teaching Institute Excellence in STEM (TIES): http://www.tiesteach.org