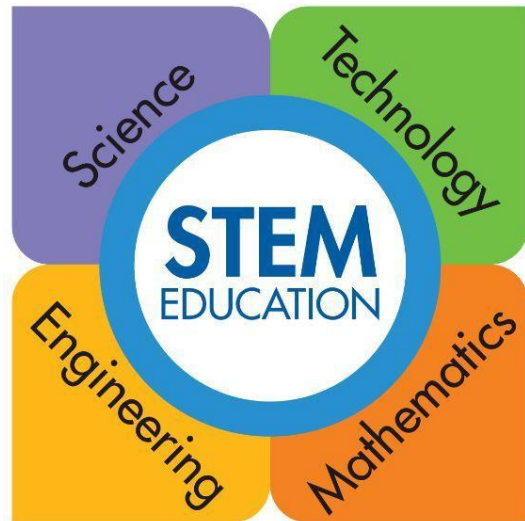


The STEM Network Presents:



The ASQ Education Division's 2020 STEM Education Resource Directory

Advancing STEM Education
Through our STEM Education Resource Directory on:

- Quality Tools for Educators
- Teaching Resources
- Continuous School Improvement

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2nd Annual STEM Education Resource Directory

Overview and Introduction to the STEM Education Resource Directory

The ASQ Education Division's STEM Education Network encourages networking on STEM Education by posting this **2020 STEM Education Resource Directory**. This Directory includes three lists of resources, each with brief descriptions and a website hyperlink for further information. The three topics this year are 1) Quality Tools for Educators, 2) Teaching Resources and 3) Continuous School Improvement. We do not make any guarantees of the accuracy of the websites, but we found the websites interesting and worth exploring. Some of the websites are quite innovative and are oriented towards encouraging students to consider STEM careers. With quality engineering's focus on science, technology, engineering and math (STEM), these STEM-related websites provide resources to continue our members' journey in life-long learning and provide members who are educators more resources to teach STEM topics to their students.

Last year, we included a list of conferences, summer camps, STEM Education events, and opportunities. With the current COVID-19 crisis and most conferences canceled, we have decided to wait on publishing our list of events and opportunities. We will post an updated list when we are more confident of whether events will occur.

In particular, on the Directory's Quality Tools for Educators list, we would like to highlight ASQ's new website on the 7 Basic Quality Tools for Process Improvement for its much improved content with examples.

We added more resources to our list for exploring Teaching Resources. The list now includes several university websites on active learning. We found that NASA has expanded their websites for educators with more content and expanded the NASA STEM Engagement for Informal Education website that includes citizen science opportunities resources.

In the Continuous School Improvement list, we included Montgomery Public Schools' website on "Baldrige: An introduction for parents" as an additional resource on the Baldrige framework for systems thinking in education.

Whether you are new to STEM Education or have experience, we think our lists will help you in your STEM Education journey and we encourage you to explore these lists. We welcome your comments and any additions you may suggest.

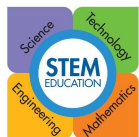


| Quality Tool(s) | Summary | For More Information |
|-----------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The 7 Basic Quality Tools for Process Improvement | ASQ website (recently updated) on the seven most used quality tools, with templates and case studies. The 7 Quality Tools include Cause-and-Effect (or Fishbone) Diagram, Check Sheet, Control Chart, Histogram, Pareto Chart, Scatter Diagram, and Stratification. Click on the Resources tab for case studies. | https://asq.org/quality-resources/seven-basic-quality-tools |
| 10 Basic Quality Tools for the Classroom | Montgomery County Public Schools' reference on additional quality tools for staff and students in the classroom with classroom examples. These Quality Tools include Plus Delta, Consenogram, Force Field Analysis, Affinity Diagram, Survey, Flow Chart, Bone Diagram, Issue Bin, Graph, and Action Plan. | http://www.montgomeryschoolsmd.org/info/baldrige/staff/qualitytools.shtm |
| Data Notebooks/Folders for Students | Montgomery County Public Schools' discussion of student data folders. These are important classroom quality tools in that " Data notebooks or folders empower students to become accountable for their learning." Examples included. | http://www.montgomeryschoolsmd.org/info/baldrige/staff/datanotebooks.shtm |
| Fishbone Diagram/ Cause & Effect Diagram | Education example on variation in learning. See "Guest Commentary: Quality and Variation in Education", by John Dew in Quality Approaches in Higher Education, Vol. 2, No. 1, page 2. | http://asq.org/edu/2011/06/best-practices/quality-approaches-in-higher-education-vol-2-no-1.pdf |
| Plan-Do-Study-Act (PDSA) cycle for continuous improvement | ASQ Education Division's PDSA poster shows components of PDSA with a brief description. | http://asq.org/edu/2010/11/basic-quality/pdsa-poster.pdf |
| Plan-Do-Study-Act (PDSA) cycle for continuous improvement | Montgomery County Public Schools' description of the Plan-Do-Study-Act cycle for continuous improvement. | https://www.montgomeryschoolsmd.org/info/baldrige/staff/qualitytools.shtm#pdsa |
| Radar Chart | Use a radar chart to monitor student achievement. See this description provided by the ASQ Service Quality Division. | http://asqservicequality.org/glossary/radar-chart/ |



| Teaching Resource | Summary | For More Information |
|---------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ASQ Certifications | ASQ's (American Society for Quality) Certification Catalog provides a resource to educators on the Quality-related certifications that ASQ sponsors. Each certification's body of knowledge and references provides a useful resource for teaching quality-related curricula and connecting classroom knowledge to the workplace. Additionally, the information on certifications shows the STEM knowledge required in the Quality field. | https://asq.org/cert/catalog |
| A World in Motion (AWIM) | Society of Automotive Engineers (SAE)'s A World in Motion (AWIM) supports classroom STEM education with STEM curricula hands-on projects in K-8 grades that are benchmarked to national education standards. | https://www.sae.org/learn/education/a-world-in-motion-teachers?tab=3 |
| Cornell University Center for Teaching Innovation's Active Learning | Suggestions for teaching at the college level using active learning methods, with ideas for getting started using active learning in the classroom. | https://teaching.cornell.edu/teaching-resources/engaging-students/active-learning |
| DiscoverE Let's Make a Difference | Useful info for educators on engineering careers and the engineering community. The Activities tab includes classroom activity packets by grade level, to engage K-12 students in engineering. | www.discovere.org |
| Discovery Education STEM Connect | Discovery Education STEM Connect provides interdisciplinary teaching resources for grades K-8 classrooms to enhance the STEM curriculum and "bring STEM to life". Teaching resources include hands-on lesson plans and digital content. | https://www.discoveryeducation.com/solutions/stem-connect/ |
| eGFI Dream Up the Future | American Society for Engineering Education (ASEE)'s eGFI provides resources on STEM and engineering education for both students and educators. Resources available to K-12 educators include lesson plans, classroom activities, outreach programs, web resources, and K-12 Education News. The online eGFI (Engineering, Go For It) magazine presents engineering examples to explain the field of engineering with an engaging format. | http://teachers.egfi-k12.org/ |
| Engineer Girl | National Academy of Engineering (NAE) Engineer Girl provides engaging information on engineering careers, engineering design and mentors to encourage girls in engineering. Includes success stories and interviews with women in engineering. | https://www.engineergirl.org/ |
| Engineering.com | Articles on latest developments in engineering innovation and industry insights and trends related to engineering could serve as teaching resources. | https://new.engineering.com/ |
| Intel Education | Enriching the Learning Experience: K-12 STEM resources for Teachers. | https://www.intel.com/content/www/us/en/education/intel-education.html |
| Khan Academy | Resources for teachers, students and parents on many STEM topics/courses. | https://www.khanacademy.org/ |
| Michigan Engineering's list of journals on teaching and learning | The Michigan Engineering Center for Research on Learning and Teaching on engineering-related journals on teaching and learning webpage provides faculty with a resource on the latest research on teaching and learning in the STEM fields. | https://crlte.engin.umich.edu/resources/journals/ |

| Teaching Resource | Summary | For More Information |
|--------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Microsoft Education | STEM lessons and classroom activities, also coding tutorials. | https://www.microsoft.com/en-us/education/education-workshop/default.aspx |
| MIT Teaching +Learning Lab Active Learning | MIT presents research that shows the benefits of teaching with active learning and includes a video with college classroom examples of implementing active learning. | https://tll.mit.edu/guidelines/active-learning |
| NAE Grand Challenges in Engineering | National Academy of Engineering (NAE) website provides ideas to excite students about engineering challenges to make the world better. | http://www.engineeringchallenges.org/ |
| NASA STEM Engagement | Useful NASA STEM engagement information for students and educators. Includes STEM examples/resources for K-12 education, higher education and informal education. Includes information on NASA Internships. | https://www.nasa.gov/stem |
| NASA STEM Engagement: Informal Education | Useful NASA information on informal STEM education resources includes citizen science opportunities, youth groups and community organizations and museums and planetariums info. | https://www.nasa.gov/stem/foreducators/informal/index.html |
| NASA STEM on Station | Useful NASA resources to learn more about the International Space Station (ISS). Includes resources for educators to bring Space into the classroom such as lesson plans, videos and latest news from the ISS. | https://www.nasa.gov/audience/foreducators/stem_on_station/index.html |
| NOAA Educator Opportunities | National Oceanic and Atmospheric Administration Information on grants, field work, and training for educators of K-12. | https://www.noaa.gov/education/opportunities/educator-opportunities |
| NSTA Resources for science teachers | National Science Teaching Association (NSTA) provides useful teaching resources, on science. Its new website has more teaching resources and is more dynamic. The Network tab provides networking topics including on remote teaching. | https://www.nsta.org/ |
| Project Lead The Way (PLTW) Resources | Project Lead The Way teaching insights, examples, and research. | https://www.pltw.org/experience-pltw/resources |
| Richard Felder's Legacy website on college teaching and learning of science and engineering education. | Resources for teaching and learning STEM at the college-level, includes practical teaching ideas, learning styles, ideas about learner-centered teaching and a blog on teaching. | https://www.engr.ncsu.edu/stem-resources/legacy-site/ |
| STEMConnector Current Research & Resources | STEMConnector webpage of STEM research and resources that educators will find useful. | https://www.stemconnector.com/publications/current-research/ |
| STEM Works | STEM resources for teachers, mentors and STEM professionals. | http://stem-works.com/ |



| Teaching Resource | Summary | For More Information |
|--------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|
| Teach Engineering STEM curriculum for K-12 | Free comprehensive STEM curriculum for K-12. Standards-aligned, curated, hands-on lessons, activities and maker challenges for teaching science, engineering and math. Includes NGSS Design-Aligned Curriculum. Search box enhances ease of finding lessons. Website is managed by the University of Colorado's College of Engineering & Applied Science. | https://www.teachengineering.org/ |
| Techbridge Girls | Resources to support girls in STEM by Techbridge: Techbridge Girls encourages equity in STEM and fair access to economic opportunity for all girls. | https://www.techbridgegirls.org/ |



| Tools / Strategies / Resources | Description | For More Information |
|-----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Baldrige in Education | Results with Baldrige in Education. Includes links to Schools/Colleges awarded National Baldrige Quality Award. | https://www.nist.gov/baldrige/results-baldrige-education |
| Baldrige: An introduction for parents | Montgomery County Public Schools' advice to parents for understanding Baldrige | https://www.montgomeryschoolsmd.org/info/baldrige/parents/ |
| Collaboration with Industry | Suggestions/examples for Industry Collaboration in "The Collaborative Role of Industry in Supporting STEM Education" by Cindy Veenstra. | https://bit.ly/2rqtZFb |
| Continuous Improvement/PDSA | "How to Plan and Implement Continuous Improvement in Schools" by Katrina Schwartz, an interview with Carnegie Foundation's Manuelito Biag on helping teachers implement PDSA in schools. | https://www.kqed.org/mindshift/51115/how-to-plan-and-implement-continuous-improvement-in-schools |
| Continuous Improvement/Systems Thinking/Collaboration with Industry to improve STEM Education | Conference proceedings and associated articles for the 2011-2013 ASQ Education Division's Advancing the STEM Agenda Conferences. | http://asq.org/edu/2014/01/continuous-improvement/conference-proceedings-asq-advancing-the-stem-agenda-conferences-2011-2013.pdf |
| Design-based Implementation Research (DBIR) | A scalable approach to continuous improvement for schools supported by current school research. This website includes current events and resources related to DBIR. | http://learndbir.org/ |
| Improvement Science | Improvement Science and User-Centered Design. Carnegie Foundation blog, "Improvement is a Team Sport", by Manuelito Biag. | https://www.carnegiefoundation.org/blog/improvement-is-a-team-sport/ |
| Leading Continuous Improvement, continuous improvement classroom | Online (open access) book <i>Leading Continuous Improvement: Inspiring Quality Education Worldwide</i> : by Jay Marino and Jan Polderman. | http://www.jaymarino.me/media/MAG_LearningContinuousImprovement.pdf |
| Networking for Improvement/State Baldrige Programs | Suggestions for getting started with Baldrige. Quality Progress article "Stately Manner" by Cindy Veenstra and Julie Furst-Bowe. | http://asq.org/quality-progress/2017/04/awards/stately-manner.pdf |
| Quality Approaches in Education | ASQ Education Division's journal, <i>Quality Approaches in Education</i> , includes articles on improving STEM Education. | http://asq.org/edu/quality-information/journals/ |
| Quality Improvement Approaches: Koalaty Kid and classroom tools | Education Division library reference on Koalaty Kid and tools for improving schools / classrooms. <i>Koalaty Kid Club Handbook</i> by Lou Ann Casey. Over the years, teachers have appreciated this book. | http://asq.org/edu/2005/08/basic-quality/koalaty-kid-club-handbook-en.pdf |

| Tools / Strategies / Resources | Description | For More Information |
|--------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Quality Improvement Approaches: Lean for Education | Lean applied to classrooms, Carnegie Foundation blog "Quality Improvement Approaches: Lean for Education" by Sarah McKay. | https://www.carnegiefoundation.org/blog/quality-improvement-approaches-lean-for-education/ |
| Quality Improvement Approaches: Positive Deviance | Positive Deviance approach with examples, Carnegie Foundation blog "Quality Improvement Approaches: Positive Deviance" by Sarah McKay. | https://www.carnegiefoundation.org/blog/quality-improvement-approaches-positive-deviance/ |
| Quality Improvement Approaches: Six Sigma | Summary of Six Sigma approach for education. Carnegie Foundation blog "Quality Improvement Approaches: Six Sigma" by Sarah McKay. | https://www.carnegiefoundation.org/blog/quality-improvement-approaches-six-sigma/ |
| Quality Improvement /Continuous Improvement/Collaboration/Baldrige | Education Division's book on improving STEM Education: <i>Advancing the STEM Agenda: Quality Improvement Supports STEM</i> by C.P. Veenstra, F. F. Padró and J. A. Furst-Bowe. Preview available on Amazon | https://asq.org/quality-press/display-item?item=E1429 |

