Chapter 16 - Resources to Explore

Sometimes the questions are complicated and the answers are simple. — Dr. Seuss

This chapter contains numerous resources including books, websites, articles, videos, and research. We list these resources (and more!) at the companion website InventtoLearn.com. As with all links in this book, we apologize in advance if they have changed by the time you read this book and will update those links online.

MAKING AND LEARNING ESSENTIAL READING

- ***Invent to Learn: Making, Tinkering, and Engineering in the Classroom*** – The book called the "bible of the classroom maker movement." The companion website for this book contains purchasing information, news from the world of making, tinkering, and engineering, all resources (plus new ones!) `InventtoLearn.com`
- ***The Children's Machine: Rethinking School In The Age Of The Computer*** – In 1993, Seymour Papert looked back on the first decade of computers in schools and predicted what what might lie ahead in this still relevant and accessible book.
- ***Maker-Centered Learning: Empowering Young People to Shape Their Worlds*** – A book from the Harvard Graduate School of Education's initiative Agency By Design offers a framework of core educational practices and ideas that define maker-centered learning.
- ***Makeology*** – This two volume series offers research and authoritative articles from top researchers around the world on makerspaces as learning environments and makers as learners.
- ***Lifelong Kindergarten: Cultivating Creativity Through Projects, Passion, Peers, and Play*** – Mitchel Resnick, the director of the Lifelong Kindergarten

- **Adafruit Learning Portal** – Projects, guides, and tutorials on Arduino, microprocessors, components, tools, and more. learn.adafruit.com
- **Raspberry Pi Foundation Projects** – This is a searchable, sortable database of beginning to advanced maker projects. The projects are NOT all Raspberry Pi, there are micro:bit projects and some with just electronics. There are also many programming projects using Scratch, Python, and App Inventor. projects.raspberrypi.org
- **Makershare** – Make Magazine and Intel sponsor this online space for maker portfolios, project tutorials, and showcases. makershare.com
- **Sylvia's Super Awesome Maker Show** – YouTube star Super-awesome Sylvia and her father produce a whimsical video show showing how to build fun electronic projects. sylviashow.com
- **Built By Kids** – Project ideas, tool tutorials, and activities for kids and families. builtbykids.com
- **Tech Will Save Us** – Creative kits and free online projects for families. Based in the UK but ships worldwide. techwillsaveus.com
- ***Meaningful Making: Projects and Inspirations for Fab Labs and Makerspaces*** – Two volumes of articles and projects contributed by FabLearn Fellows, educators in formal and informal fabrication labs and makerspaces worldwide.

Good Starter Projects

- **Marble runs and ramps** – The Tinkering Studio site for Marble Machines. These large scale machines are built for crowds, but the resources will be helpful for any size build. exploratorium.edu/tinkering/projects/marble-machines
- **Scribbling machines** – Easy to build robots using scrap materials with pens for legs and a small off-center motor. The vibrating motor causes the robot to dance around and scribble on a large sheet of paper. exploratorium.edu/tinkering/projects/scribbling-machines
- **LEGO Art Machines Kit** – The Tinkering Studio guides and parts lists for LEGO Art Machine activities. exploratorium.edu/tinkering/blog/2016/12/12/lego-art-machines-kit-
- **Squishy Circuits** – The home of all things related to Squishy Circuits, homemade conductive and insulating dough for playing and learning about electronics. Recipes, kits, and videos showing how to use Squishy Circuit dough to teach electronics. squishycircuits.com
- **Wind Tubes** – Easy to make large upright tubes with a fan at the bottom. Makers can build "stuff that floats" out of recycled materials, put their creations in the tube and watch them fly up to the sky! exploratorium.edu/tinkering/projects/wind-tubes
- **Digitally Interfaced Book: Paper, Graphite, Makey Makey, Scratch, and Imagination** – Instructions for completing an interactive book project. digitalis.nwp.org/resource/4885

- ***The Best of Instructables Volume I*** – Do-It-Yourself Projects from the World's Biggest Show & Tell.
- ***The Way Things Work Now*** – Every classroom needs at least one copy of David Macaulay's beautifully illustrated book of how things work. Updated with the latest in technology developments.
- ***How Does My Home Work?*** – The inner workings of a home are laid out for kids ages 5-8 in fun, retro illustrations jam-packed with the technology behind everyday life.
- ***Smithsonian Maker Lab Series*** – Beautiful STEM and maker project books from the Smithsonian and DK for kids 8-14.
- ***Making Things Move DIY Mechanisms for Inventors, Hobbyists, and Artists*** – Learn how to build moving mechanisms with and without motors. A wealth of clear explanations, examples, and try-it projects. The explanations of different materials and fastening techniques will be referred to often.
- ***Photojojo!: Insanely Great Photo Projects and DIY Ideas*** – This book is filled with insanely creative ways to turn your photographs into amazing products and crazy ways to capture photographs you won't believe. Fun for the whole family!
- ***Klutz LEGO Books*** – Klutz has a line of LEGO books that illustrate simple mechanical concepts that may be generalized into larger personal projects.
- ***Out of the Box: 25 Cardboard Engineering Projects for Makers*** – 25 creative projects for primary aged children using cardboard and simple recycled materials.
- ***Jane Bull books*** – Every one of Jane Bull's beautiful craft, sewing, cooking, and making books will delight and inspire kids. They all deserve a place in every classroom or maker space library.
- ***Recycle This Book: 100 Top Children's Book Authors Tell You How to Go Green*** – Essays from renowned children's book authors provide an informative and inspiring call to kids of all ages to understand what's happening to the environment, and take action in saving our world.
- ***Steven Caney's Invention Book*** – Steve Caney's books are mostly out of print, but available used online. All his books are full of whimsical projects that are good to have in a makerspace for inspiration.
- ***3D Printing Projects*** – A user friendly family guide to 3D printing from DK.

Books for Families

- ***Geek Dad: Awesomely Geeky Projects and Activities for Dads and Kids to Share*** – The Geek Dad series features books of cool family projects, science experiments, and more.
- ***Geek Mom: Projects, Tips, and Adventures for Moms and Their 21st-Century Families*** – More fun projects for families to build together.
- ***50 Dangerous Things (You Should Let Your Children Do and Why)*** – Gever Tulley's self-explanatory classic on messing-about in the real world with real stuff, just like real kids.

COMPETITIONS

- **FIRST LEGO League (FLL)** – Worldwide robotics competitions for youth ages 9-16. `firstlegoleague.org`
- **Nerdy Derby** – Offers free resources and curriculum for a car construction and racing activity focused on creativity, not competition. `nerdyderby.com`
- **Botball** – A team-oriented robotics competition that focuses on reusable components and autonomous programs (no remote controls), that encourages creativity and programming. `botball.org`

MAKERSPACE AND HACKERSPACE DIRECTORIES

- **Makerspace Meetup group** – Meetup.com coordinates informal gatherings around the world. Check on related topics including makerspaces, robotics, 3D printing, Arduino, etc. for meetings near you. `meetup.com/topics/makerspaces`
- **Hackerspaces.org** – A list of hackerspaces worldwide, events, challenges, resources, and more. `hackerspaces.org`
- **The Maker Map** – A crowdsourced global map of makerspaces of all kinds, community tool providers, recycling centers, sources of metal and other materials, and more. `themakermap.com`
- **Altas of Community Innovation Spaces** – Crowdsourced map of Fab Labs, makerspaces, hackerspaces and other community spaces. `atlasofinnovation.com/map`

MAKER EDUCATION

Guides

- **Family Creative Learning Facilitator Guide** – Ricarose Roque and Saskia Leggett provide a planning framework and resources for family creativity workshops encouraging design and making. `familycreativelearning.org/guide`
- **Makerspace Playbook** – Ideas for schools starting a makerspace or planning a licensed Mini-Maker Faire from the MakerEd Initiative. `makered.org/makerspaces`
- ***Start Making!: A Guide to Engaging Young People in Maker Activities*** – A guide to facilitating maker activities for youth developed by the Computer Clubhouse Network. Excellent projects, activities, and suggestions for encouraging meaningful learning in school or community spaces.
- ***The Big Book of Makerspace Projects: Inspiring Makers to Experiment, Create, and Learn*** – A terrific starter book by Colleen Graves and Aaron Graves for teachers or librarians getting started with making. Includes a wide variety of low- and high-tech activities and advice about creating and managing effectively.

- **Making it Happen** – Summary of a Library Journal survey of public libraries with makerspaces. Detailed analysis of what kinds of programming are offered, successful practices, and cost breakdowns. Download the full report from this site. `libraryjournal.com/?detailStory=making-it-happen-programming`
- **School Library Journal: The Maker Issue** – Articles about school library makerspace programs and resources for all grade levels. `slj.com/features/the-maker-issue-slj-2015`

SCHOOL AND MAKERSPACE DESIGN

- ***The Language of School Design: Design Patterns for 21st Century Schools*** – A lavishly illustrated guide to school architecture and designing learning spaces by Prakash Nair and Randall Fielding.
- ***Make Space: How to Set the Stage for Creative Collaboration*** – By Scott Doorley and Scott Witthoft from the Stanford Design School. This book is is full of good ideas for all spaces and budgets for changing surroundings to enhance the ways in which teams and individuals communicate, work, play, and innovate.
- ***The Third Teacher*** – Created by an international team of architects and designers, this book explores the critical link between the school environment and how children learn, and offers 79 practical design ideas, both great and small, to improve schools.
- ***Blueprint for Tomorrow: Redesigning Schools for Student-Centered Learning*** – Prakash Nair, one of the world's leading school designers, explores the hidden messages that our school facilities and classrooms convey and advocates for the "alignment" of the design of places in which we teach and learn with twenty-first-century learning goals. The book includes simple, affordable, and versatile ideas for adapting or redesigning school spaces.

PLACES TO PURCHASE PARTS AND SUPPLIES

- **Sparkfun Electronics** – Specializes in hobbyist electronic components, tools, and kits. The website features a project blog, buying guides, and tutorials from soldering to using a breadboard. Ask for educator discounts. `sparkfun.com`
- **Adafruit** – Unique and Fun DIY Electronics and Kits. Check the Young Engineers section for selections that are whimsical and fun. Ask for educator discounts. `adafruit.com`
- **Maker Shed** – Make Magazine online store. Kits, maker hobby items, and books. `makershed.com`
- **Robotshop** – All your robot needs in one place. Robots for home, school, and professional use, plus drones, wearable technology, kits, toys, parts, and apps. `robotshop.com`
- **Digikey** – Extensive collection of electronic components. If you can't find it here, it might not exist! `digikey.com`

- **National Institute of Health 3D Print Exchange** – A database of scientific and medial 3D models such as bacteria, body parts, organs, cells, organisms, and labware. There are curated collections for prosthetics, neuroscience, and more. `3dprint.nih.gov`
- **Sketchfab** – Purchase 3D models or publish your own. Many models can be 3D printed, but also can be displayed online or for VR headsets. The British Museum curates a collection of its scanned artifacts on this site. `sketchfab.com`
- **Smithsonian 3D Program** – The Smithsonian Museum is working to digitize artifacts from their collection, and has started putting some of these online. The website also includes educator resources and some fascinating videos of how the museum uses 3D and other technology to document and explore objects. `3d.si.edu`
- **YouMagine** – A database of open source 3D designs for print. Started by the founders of the 3D printer company Ultimaker. `youmagine.com`
- **e-NABLE** – A global exchange to match people with fabrication devices with people who need prosthetics and can't afford them. `enablingthefuture.org`
- **Matterhackers** – Software, projects, and equipment for fabrication. `matterhackers.com`

3D Printing

- **Instructables Introduction to 3D printing** – Simple introduction to 3D printing with many photographs. `instructables.com/id/3D-Printing-1`
- **3D Printing News** – News articles about global 3D fabrication in industry, medicine, art, and more. `on3dprinting.com`
- ***3D Printing Projects*** – A user friendly family guide to 3D printing from DK.
- ***Functional Design for 3D Printing: Designing 3D Printed Things for Everyday Use*** – Learn design practices that result in durable, functional objects that print reliably.
- ***The Invent to Learn Guide to 3D Printing in the Classroom: Recipes for Success*** – by David Thornburg, Norma Thornburg, and Sara Armstrong. This book is an essential guide for educators interested in bringing the amazing world of 3D printing to their classrooms.

Subtractive Machines (Cutters & Others)

- **Laser Cutting Basics** – Instructables illustrated guide to getting started with laser cutters. `instructables.com/id/Laser-Cutting-Basics`
- **Guide to Laser Cutting in Education** – This brochure from Epilog is an overview of how laser cutters are used in school makerspaces. `epiloglaser.com/resources/e-brochures/lasers-in-education-guidebook.pdf`
- **Laser Cutter E-books** – Free e-books about using laser cutters from Obrary, a design website. `obrary.com/collections/ebooks`

- **Adafruit Arduino Lessons** – Free online series of lessons for beginners written by Simon Monk. `learn.adafruit.com/lesson-0-getting-started`
- **Super Awesome Sylvia's Simple Arduino Projects** – Fun video tutorials for two simple Arduino projects `sylviashow.com/episodes/s1/e3/full/arduino`
- **Instructables Arduino Projects** – A curated collection of Arduino projects at varying levels of complexity from the editors at Instructables. `instructables.com/id/Arduino-Projects`
- ***Getting Started with Arduino*** – A handy little guide to getting started on Arduino by Massimo Banzi, one of the inventors of the Arduino.
- *Arduino Project Handbooks* – Each of these two volumes by Mark Geddes has a getting started guide, plus 25 projects for Arduino beginners. Projects include step by step instructions and well-chosen close up color photographs. The volumes cover different skills and components, so buy both!
- ***Sylvia's Super Awesome Project Book – Super Simple Arduino!*** – YouTube star Super-Awesome Sylvia introduces young makers to programming and hardware using the Arduino microcontroller.
- ***The Arduino Inventor's Guide: Learn Electronics by Making 10 Awesome Projects*** – Good Arduino project book by Brian Huang and Derek Runberg that focuses on building skills in electronics.
- ***Making Things Talk: Using Sensors, Networks, and Arduino to See, Hear, and Feel Your World*** – Sophisticated but very cool networking projects using sensors and microcontrollers. by Tom Igoe, one of the inventors of the Arduino.

Arduino Programming

- **Arduino IDE** – The Arduino Integrated Development Environment (IDE) is downloadable software used to program Arduino boards. `arduino.cc`
- **Arduino Create** – Online hub for Arduino projects, a cloud-based coding environment, and circuit design. You must still download and install a plug-in, but it means you always have the latest version. There is a subscription service available for schools to integrate it into Google Apps for Education. `create.arduino.cc`
- ***Programming Arduino: Getting Started with Sketches*** – By Simon Monk. Clear, easy-to-follow downloadable examples show you how to program Arduino in C. This is a must have book for learning to use the Arduino.
- ***Adventures in Arduino*** – A beginner's guide to Arduino programming for ages 11-15 by Becky Stewart.

Micro:bit

- **Micro:bit Foundation** – A non-profit organization supporting the BBC micro:bit, a versatile microcontroller board. Resources for students, teachers, developers, and an online community. `microbit.org`
- **Micro:bit magazine** – Free online magazine about the BBC micro:bit. `micromag.cc`

- **Gellacraft** – Tutorials and ideas for e-textiles, sewable projects, costume design, and more from Angela Sheehan, a maker and educator. `gellacraft.com`
- **Getting Hands-on with Soft Circuits** – An e-textile workshop facilitators guide by Emily Lovell (e-book) `web.media.mit.edu/~emme/guide.pdf`
- **e-Textiles in a Box** – Free resource from the National Council of Women & Information Technology (NCWIT) provides activities that teach about sewing soft circuits and programming. `ncwit.org/resources/e-textiles-box`
- **Stitching the Loop** – A project-based electronic textile unit for Exploring Computer Science, a high school intro level CS course, but could be adapted for lower grades. Free downloadable guides offer extensive teacher and student resources. `exploringcs.org/e-textiles`
- **Soft Robotics Toolkit** – Resources to support the design, fabrication, and control of soft robotic devices, originally developed by the Harvard Biodesign Lab with additional contributions such as an open source fluidic control board, soft actuators and sensors, and other downloadable files. Hosts an annual design competition. `softroboticstoolkit.com`
- ***Sew Electric*** – by Leah Buechley, Kanjun Qiu, and Sonja de Boer. This book contains projects ranging from simple to complex that teach different aspects of sewing with electronics, leading up to programming the Lilypad Arduino.
- ***Textile Messages: Dispatches from the World of E-Textiles and Education*** – By Kylie Peppler, Leah Buechley, Michael Eisenberg, and Yasmin Kafai. This book contains both the "what" and "why" of using e-textiles in education.
- ***Sewing School: 21 Sewing Projects Kids Will Love to Make*** – This beautifully photographed spiral-bound book by Andria Lisle will help kids age 5-13 develop sewing skills to support your eTextile projects or inspire projects that may be electrified! There are projects that will appeal to both boys and girls, and the photos are gender-balanced.
- ***A Child's First Sewing Book: Mid-century Hand-sewing Inspiration and Projects for Children*** – A charming reproduction of a mid-century sewing instruction book, filled with practical illustrations and diagrams for kids age 8+.

Raspberry Pi

- **Raspberry Pi Foundation** – Main website for all things Raspberry Pi. `raspberrypi.org`
- **MagPi** – The official Raspberry Pi magazine. Free online, or you can subscribe to the glossy print version. `raspberrypi.org/magpi`
- **Make Magazine Raspberry Pi** – Projects, ideas, and resources for using the Raspberry Pi. `makezine.com/category/technology/raspberry-pi`
- ***Raspberry Pi For Kids*** – Good project book written for kids ages 10-13 (but not dumbed down) about getting started with Raspberry Pi.
- ***Adventures in Raspberry Pi*** – Learn to set up and program the Raspberry Pi through fun projects for ages 11 -17. A companion website has video instructions for each project.

ELECTRONICS

- **Adafruit's Circuit Playground** – A YouTube channel with videos about electronic concepts. bit.ly/circuitvideos
- **Science Snacks: Electricity and Magnetism** – The San Francisco Exploratorium offers a selection of short projects using free and easy to find materials on a variety of topics. exploratorium.edu/snacks/subject/electricity-and-magnetism
- **Bare (conductive) Paint** – Paint pens and interactive card kits. This is a UK-based company; some of their materials are available at ThinkGeek and Amazon. bareconductive.com
- **Circuit Scribe** – Conductive paint pens and electronics kits. circuitscribe.com
- **Instructables How to Solder** – A comprehensive guide to soldering, safety, and using the right tools. instructables.com/id/How-to-solder
- **Sylvia's Maker Show How To Solder Flyer** – Fun handout on how to solder with great tips and safety instructions. sylviashow.com/printables/how-solder
- ***Make: Electronics: Learning Through Discovery*** – Charles Platt's thorough text explaining the world of electronics—a great resource for your library.
- ***A Beginner's Guide to Circuits*** – A concise book offers nine simple projects that introduce electronic concepts.
- ***Electronics for Kids: Play with Simple Circuits and Experiment with Electricity!*** – A comprehensive beginning electronics guide.

ELECTRONICS BUILDING KITS

- **Chibitronics (Circuit Stickers)** – Chibitronics offers beautiful kits and materials for making paper circuits. Circuit Stickers are easy to use for young circuit designers. The **Chibi Chip** adds microcontroller capability to paper circuits. chibitronics.com
- **littleBits** – Electronic building blocks for children, color-coded by functionality, that snap together with rare earth magnets. This eliminates the possibility for incorrect connections, short circuits, and syntax errors in order to facilitate electronic tinkering by learners of all ages. littlebits.com
- **Snap Circuits** – Explore electronic circuitry, with and without a computer, with snap together components to make working circuits and machines. elenco.com/brand/snap-circuits
- **Lectrify** – Small circuit components work with paper, wearables, and any arts and crafts project. The pieces are designed to reflect real electronic components, providing but not forcing a pathway to understanding electronic design. lectrify.it
- **Circuit Arcade** – Instructions to make your own DIY cardboard circuit components. makerpromise.org/circuit-arcade

- **ScratchED web site** – An online community and resources for educators who teach with Scratch. `scratched.gse.harvard.edu`
- **LEGO WeDo programming in Scratch** – Scratch also may be used to program LEGO's early childhood robotics set called WeDo. Plug the LEGO WeDo 2.0 into your computer and new blocks appear for robotics control in Scratch. `scratch.mit.edu/wedo`
- ***Super Scratch Programming Adventure!: Learn to Program By Making Cool Games (Version 2)*** – A full-color cartoon style project book for learning Scratch programming.
- ***Scratch For Kids For Dummies*** – A terrific project-based approach to learning Scratch by Derek Breen.
- ***Code Your Own Games! 20 Games to Create with Scratch*** – A lovely 80-page spiralbound book by Max Wainewright with gorgeous graphics and a straightforward approach to helping kids learn to program in Scratch by creating twenty different game projects sequenced by degree of difficulty.
- ***Advanced Scratch Programming: Learn to Design Programs for Challenging Games, Puzzles, and Animations*** – For students who already know Scratch, this book by Abhay B. Joshi introduces more advanced concepts and a deliberate design approach through projects. There is a free supplement online that aligns Scratch with formal Computer Science concepts.

Block-based languages

- **Snap!** – Scratch with first-class objects added to make more complex programming projects possible. `snap.berkeley.edu`
- **Turtle Art** – A simple yet elegant variation of Logo with an iconic interface intended to create beautiful images. `turtleart.org`
- **Turtle Blocks** – A variation of Turtle Art developed for the One Laptop Per Child (OLPC) project that runs on Chromebooks. `turtle.sugarlabs.org`
- **Tickle** – An iOS block-based programming environment with a lot of Scratch functionality that can control many popular Bluetooth robotics toys and drones. The basic app is free, but you need to pay a few dollars to add functionality for some devices. `tickleapp.com`
- **Droneblocks** – A free block-based programming environment for iOS, Android, and Chrome that allows users to program a variety of popular DJI drones from toys to prosumer models. `droneblocks.io`

Python

- **Python** – Python is an easy to learn, flexible programming language. Find resources, documentation, stories, and community on the website. `python.org`
- **Invent Your Own Computer Games with Python** – First in a series of Python books by Al Sweigart. Most are available online for free. `inventwithpython.com`
- ***Python for Kids: A Playful Introduction to Programming*** – A good guide for getting started with Python by Jason R. Briggs.

- **Lemelson-MIT Program** – Grants and contests for grades 7-12. Celebrates outstanding inventors and inspires young people to pursue creative lives and careers through invention. `lemelson.mit.edu`
- **Spark!Lab Invention Projects** – A list of activities to make your own light bulb, gramophone, and other famous inventions from the Spark!Lab at the National Museum of American History in Washington, DC. `americanhistory.si.edu/exhibitions/sparklab`
- **Edison Muckers** – All about Edison and inventing. `edisonmuckers.org`
- **UN Sustainable Development Goals** – 17 goals to transform the world are a "to do" list for the future and can be used as the basis for challenges and projects. `un.org/sustainabledevelopment`
- **Scistarter** – Searchable database of science projects open to public participation. `scistarter.com/finder`
- **Citizenscience.gov** – Official US government site coordinating crowdsourcing and citizen science initiatives in the US. `citizenscience.gov`

COPYRIGHT AND INTELLECTUAL PROPERTY

- **Creative Commons** – Free, easy-to-use copyright licenses provide a simple, standardized way to give the public permission to share and use your creative work — on conditions of your choice. `creativecommons.org`
- **Q&A: Makerspaces, Media Labs and Other Forums for Content Creation in Libraries** – The American Library Association's guide to user rights and intellectual property issues for libraries as they create policies for makerspaces or other content creation forums. `ala.org/advocacy/intfreedom/statementspols/contentcreationQA`
- **3 Steps for Licensing Your 3D Printed Stuff** – A practical step-by-step process for understanding licensing and 3D printed objects, images, and designs by Michael Weinberg. `bit.ly/license3D`
- **It Will Be Awesome if They Don't Screw it Up: 3D Printing, Intellectual Property, and the Fight Over the Next Great Disruptive Technology** – Michael Weinberg examines the potential impact of current intellectual property laws on 3D printing and what the future holds. `bit.ly/awesome3D`

REGGIO EMILIA APPROACH

The municipal pre-schools of Reggio Emilia Italy are widely considered the best schools in the world. These resources document their approach to project-based learning and serve as inpiration for educators of all grade levels.

- **Reggio Children** – The international resource for educators interested in the Reggio Emilia Approach. `reggiochildren.it`
- **Reggio Children Books & DVDs** – Official distributor of Reggio Children resources. `store.reggioalliance.org`

- **Climbing to Understanding: Lessons from an Experimental Learning Environment for Adjudicated Youth** – By David Cavallo, Seymour Papert, and Gary Stager.
  stager.org/articles/ICLS%20stager%20papert%20cavallo%20paper.pdf
- **Constructivism(s): Shared Roots, Crossed Paths, Multiple Legacies** – A brilliant overview of constructivism and constructionism by Edith Ackermann. bit.ly/constructivisms
- **Computer as Mudpie** – By Seymour Papert. Connecting the natural learning instincts of children with what they can do as they program a computer.
  bit.ly/fUik9v
- **Epistemological Pluralism and the Revaluation of the Concrete** – An incredibly powerful paper by Sherry Turkle and Seymour Papert about learning styles. papert.org/articles/EpistemologicalPluralism.html
- **Constructionism vs. Instructionism** – A transcription of a talk by Seymour Papert explaining how these two models of education differ.
  papert.org/articles/const_inst/const_inst1.html
- **Constructionism: New Technologies, New Purposes (video)** – Mike Eisenberg's plenary address at the Constructionism 2012 Conference in Athens, Greece. Anyone interested in learning, emerging technology, creativity, the arts, science, or craft would be wise to watch this terrific presentation.
  vimeo.com/49891132
- **Situating Constructionism** – The first chapter from the book *Constructionism*, edited by Idit Harel and Seymour Papert.
  papert.org/articles/SituatingConstructionism.html
- ***The Computer Clubhouse: Constructionism and Creativity in Youth Communities*** – by Yasmin Kafai, Kylie Peppler, and Robbin Chapman. Extensive resources and research on the positive impact on youth at over 100 after school computer centers in communities across the US.
- ***Constructionism in Practice: Designing, Thinking, and Learning in A Digital World*** – By Yasmin B. Kafai and Mitchel Resnick.

TINKERING & PLAY RESOURCES

- ***Purposeful Play: A Teacher's Guide to Igniting Deep and Joyful Learning Across the Day*** – Lessons, classroom setups, and helpful tools and charts to infuse play across the curriculum.
- **American Journal of Play** – Peer reviewed but accessible for a wide audience, the journal covers the history, science, and culture of play to increase awareness and understanding of the role of play in learning and human development and the ways in which play illuminates cultural history.
  journalofplay.org
- **Learning Through Play Resources** – LEGO Foundation resources on learning through play. Research, videos, and activity guides.
  legofoundation.com/en/learn-how

- **Girls in Tech** – By Sylvia Martinez for Intel Australia. A free guide about how maker education can support equity for girls in STEM. sylviamartinez.com/girls-in-tech-handout-intel-australia
- **Tinkering Spaces: How Equity Means More Than Access** – Interviews with several educators working to provide equitable access to makerspaces to youth. kqed.org/mindshift/44915/tinkering-spaces-how-equity-means-more-than-access
- **Thinking about Making (Video)** – Leah Buechley challenges the maker movement to broaden participation and access for all, especially in schools. vimeo.com/110616469
- **Recontextualizing the Makerspace: Culturally Responsive Education** – Nettrice Gaskins argues for a redefinition of technology and technological processes that include engagements by groups underrepresented in the DIY/makerspace/hacker culture movement. bit.ly/2IQTnvO
- **On Equity Issues in the Maker Movement, and Implications for Making and Learning** – Rafi Santo addresses the serious equity issues found in the maker movement and provides links to many organizations working to provide more equitable making experiences. bit.ly/makersanto

RESEARCH GROUPS

- **Agency by Design** – Harvard Graduate School of Education project investigating the promises, practices, and pedagogies of maker-centered learning. agencybydesign.org
- **Carnegie Mellon CREATE Lab** – The Community Robotics, Education and Technology Empowerment Lab (CREATE Lab) explores socially meaningful innovation and deployment of robotic technologies. cmucreatelab.org
- **FabLearn** – FabLearn is a project led by Paulo Blikstein at Columbia University Teachers College. It supports digital fabrication and making in K-12 schools through supported labs, research, and conferences. fablearn.org
- **Craft Tech Lab** – Mike Eisenberg heads this research group at Colorado University, Boulder interweaving computation and craft materials. Website offers research, resources, and community outreach events. l3d.cs.colorado.edu/~ctg/Craft_Tech.html
- **MIT Center for Bits and Atoms** – Neil Gershenfeld's fabrication research lab at MIT and global Fab Lab network. cba.mit.edu
- **MIT Media Lab Lifelong Kindergarten Group** – Mitchel Rensick's constructionist research group at MIT and the home of the Scratch programming language. llk.media.mit.edu
- **The Creativity Labs @ Indiana University** – Research group that brings together educators, designers, artists, and learning theorists interested in constructionist and design-based learning. They focus on computational tools that support learning by leveraging youths' interests in digital culture, design, and making. creativitylabs.com

- ***Free to Make: How the Maker Movement is Changing Our Schools, Our Jobs, and Our Minds*** – By Dale Dougherty, founder and CEO of Maker Media, *Make* magazine, and the Maker Faire, provides a guided tour of the maker movement.
- ***Makers: The New Industrial Revolution*** – This book about the maker revolution is by the former editor of Wired Magazine Chris Anderson.

HISTORY AND FUTURE

- ***Hackers: Heroes of the Computer Revolution*** – Steven Levy's classic masterpiece about the history of computing and the geniuses who invented our digital world.
- ***The Media Lab: Inventing the Future at M.I.T.*** – Stewart Brand's vision of what's coming from the research scientists at the Media Lab.
- ***The Second Self: Computers and the Human Spirit*** – Well before the internet was available in our pockets or the rise of social media, Sherry Turkle wrote about computers as part of our social and psychological lives.
- ***Designing Reality: How to Survive and Thrive in the Third Digital Revolution*** – Neil Gershenfeld and his two brothers forecast a world where fabrication technology looks like a universal replicator straight out of Star Trek. They disagree, however, on whether this will democratize fabrication, creating self-sufficient cities and the ability to make (almost) anything, or whether it will lead to massive inequality.

AUTHOR WEBSITES

- **Invent To Learn book and website** – The companion website for this book contains purchasing information, news from the world of making, tinkering, and engineering, all resources (plus new ones!) `inventtolearn.com`
- **Sylvia Martinez's website and blog** – Sylvia writes about how empowering students can improve school and change lives. `sylviamartinez.com`
- **Gary Stager's website** – A collection of articles, resources, and videos from Gary Stager. `stager.org`
- **Gary Stager's blog** – Gary writes thoughtful, provocative essays on many topics `stager.tv/blog`
- **Constructing Modern Knowledge Press** – Gary and Sylvia run CMK Press, a publishing company dedicated to creating books for the modern learner. `cmkpress.com`
- **CMK Futures** – Constructing Modern Knowledge Futures is a site for books, professional development, and events that support modern learning. `cmkfutures.com`