Makerspace Planning Process
Professional Development
Kim Brand, 1st Maker Space, LLC

"Your 1st Maker Space is free – it's between your ears"

Background & Education Makerspace resources

- Maker Mindset by Dale Dougherty, Founder of Make Magazine
- Agency by Design – Maker Centered Learning and the Development of Self: Preliminary Findings of the Agency by Design Project, Harvard Graduate School of Education
- Makerspace Playbook – School Edition; Youth Makerspace Playbook
- Maker Movement Manifesto (Chapter 1) – Mark Hatch, Former CEO: TechShop
- Makerspace For Education (The Making of a Makerspace: Pedagogical and Physical Transformations of Teaching and Learning)
- District Administration – Meeting of the Mindsets
- Meaningful Making: Projects and Inspirations for Fab Labs + Makerspaces, Stanford University
- Seven Makerspace Things You Should Know
- 8 Tips to Taking on Schoolwide Makerspace Leadership
- Making an Educational Makerspace, Kurti, et. al. 2015
    - The Philosophy of an Educational Makerspace
    - The Environment and Tools of Great Educational Makerspaces
    - Practical Implementation of an Educational Makerspace
- CTE Makeover Challenge

"Put a young man in a workshop, his hands will work to the benefit of his brain and he will become a philosopher while thinking himself only a craftsman." – Jean-Jacques Rousseau

Brand's 'Makerspace' Taxonomy

- Materials: All created from exploding stars
    - Materials petting zoo
- Measurement: To amplify our senses
    - Foundation of Units
    - Metric vs English
    - Scale (Powers of 10 video)
    - Measurement Scavenger Hunt
- Tools: To amplify our power
    - "Man is a Tool-using Animal. Weak in himself, and of small stature, he stands on a basis, at most for the flattest-soled, of some half square foot, insecurely enough; has to straddle out his legs, lest the very wind supplant him. Feeblest of bipeds! Three quintals are a crushing load for him; the steer of the meadow tosses him aloft, like a waste rag. Nevertheless he can use Tools, can devise Tools: with these the granite mountain melts into light dust before him; seas are his smooth highway, winds and fire his unwearying steeds. Nowhere do you find him without Tools; without Tools he is nothing, with Tools he is all." —– Thomas Carlyle

- Fabrication: Turning intention into reality
- Control: To project power and intelligence

Self discovery and personal inquiry are best – but standards aligned activities are no less fun and engaging when done right.

Let Kids Play, Fail, Lead

- A Makerspace is like a golf course – there are many similarities among them – but none are the same.
- A Makerspace is never complete. The imagination and contributions of students and teachers are constantly invested in continuous change and improvement.
- A Makerspace gives nearly instant feedback - ideas, hypothesis, concepts, designs, techniques, choice of materials and tools can be reformed/iterated very quickly. This leads to problem solving mastery where f*ailure is simply feedback*. Great video: "Fail forward" from Jeri Ellsworth.
- A Makerspace encourages collaboration and communication – and teaches tolerance for other students' ideas. When a better thing is made peer learning and flexibility with one's own designs results.

What is YOUR makerspace mission?

Four Es of makerspace success

- Establish a maker champions committee – students, educators, parents, administration, businesses
- Enlist the support of the community – PR, donations (materials, time, cash,) project ideas, skills, employers
- Exhibit maker products to spark creativity, participation and enthusiasm for making; marketing plan
- Entrepreneurship - to bring authentic/profit making enterprises to the space to subsidize costs

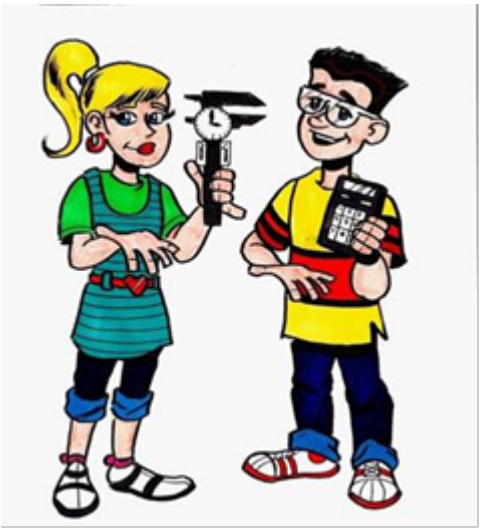
Additional resources

- 1st Maker Space Makerspace Operation Manual (MOM)
- 1st Maker Space Safety Basics (based on ITEEA Safer Makerspaces, Fab Labs and STEM Labs.)
- Cornell University Toolbox Safety Talk
- Instructables
- Thingiverse Education
- Makered.org (Makerspace Playbook, Makerspace Literature Review)
- Talking Electronics
- Tinkercad – free web-based 3D modeling program
- Novice's Guide to 3D Printing (Brand, 2016)
- Pinterest
- AdaFruit and SparkFun (Electronics)
- Vex (Robotics – Engineering curriculum)

- Make Magazine
- NASA (STEM for Educators)
- Makerspaces.com
- Twitter & your personal social/maker network
- Xerox: The Engineer's Mindset
- Simplify3D – 3D printer control software

Popular Tools/Technologies/Curricula

- BBC MicroBits (Free educator resources here and here and here.)
- All about MIT Scratch
- MakerBit and HyperDuino (Roger Wagner)
- Raspberry Pi & Arduino
- Hummingbird Robotics
- Dobot Magician: All in One Robot Arm
- Adafruit and Sparkfun and Hackaday and Evil Mad Scientist and Thingiverse
- Brown Dog Gadgets & Talking Electronics (Electronics)
- TeacherGeek.com maker supplies
- Makey – Makey
- Littlebits
- Dash & Dot (Coding, Robotics)
- Engineering by Design PK12 Curriculum
- Design Thinking for Educators (whitepaper) and Curious about Design Thinking? (webpage)
- Preparing Students for a Project Based World
- The importance of woodworking



Engaging students in the construction of a makerspace

- Definition of mission and scope
- Painting, Decorating, Interior Design
- Exhibit of made objects & projects
- Makerspace 'store'
- Integration with existing clubs
- All curricula, specials, all stake holders
- Makerspace catalog
- Holiday making
    - Valentine's Day, February 14
    - Easter, April 1
    - Maker Mothers Day, May 13, 2018
    - Fab Fathers Day, June 17, 2018
    - Halloween, October 31
    - Christmas, December 25
- Reach out to older/younger kids in nearby schools/home schools

    - Project ideas
    - Needs

1st Maker Space 'Maker Fundamentals' series

- Safety Training
    - Safer Makerspaces, Fab Labs and STEM Labs
    - Cornell University Toolbox Safety Talk
    - MSDS Binder
    - OSHA-10 Safety Certification
    - Laser Safety
    - Laser Cutter Materials
    - Electrical Safety
    - Typical HS Makerspace Safety Policy
    - Safety Poster
    - IPS Accident Report
    - College Makerspace Shop Safety
    - Safety pertaining to individual pieces of equipment
- Maker ethics
    - Organization and sharing everything
    - Presentations & display
    - Collaboration, Feedback and Compliments
    - Fail forward
    - Patents and intellectual property
- Materials Petting Zoo
- Fastener Petting Zoo
- Measurement Petting Zoo
- Tool Petting Zoo
- 2D Design and 3D modeling
- 3D Printer Training & Projects
- 3D Printer Troubleshooting
- Laser Cutter Training & Projects (for Rabbit Laser)
- Sewing Training & Projects
- Vinyl Cutter Training
- Screen Printer Training
- *Fabrication Phonics* & Projects
    - Assembly
    - Tolerances
    - Tools and Fixtures & Fasteners
    - Prototypes
    - Cardboard Challenge

- *Electronics Phonics* & Projects
    - Soldering

    - Charge, Volts, Amps, Power & polarity
    - Timescales
    - Passive components
    - Transistors: amplifiers and switches, bits and logic
    - Basic circuits & breadboarding
    - Sound & Hearing
    - Light & Vision
    - Coding Basics
        - Flowcharting
        - Variables, Conditionals
        - Flow control & multitasking
        - Languages
        - Persistence
        - User Interfaces
        - Scratch
        - Javascript
        - Python
    - MicroBits & Raspberry Pi & Arduino
- *Robotics Phonics* & Projects
    - Sensors
    - Actuators
    - Controllers
    - Competitive Robotics Ecosystems: First, Vex, etc.
- Troubleshooting Certification

Making by grade level; afterschool & summer programs

- Primary grades
- Afterschool Makerspaces
- Indiana Afterschool Network STEM Qualifications
- Engineering By Design K12 Standards mapping
- A Framework for Maker Activities

Makerspace Assessment, Research & Standards Alignment

PBL + STEM research

> Buck Institute for Education (BIE) defines PBL as "a teaching method in which students gain knowledge and skills by working for an extended period of time to investigate and respond to an engaging and complex question, problem, or challenge"

- The Impact of PBL Learning on STEM Education in High Need Schools
- Literature Review of PBL
- Project Based Learning, A Literature Review
- Six Must Haves for developing a Maker Mindset
- DEMCO Maker's Guide: A framework for Maker education
- Characteristics of Authentic Learning – Buck Institute for Education
- Creating an Authentic Maker Education Rubric

- Maker Assessment rubric
- Doug Hunt – E-TEI Conference Design Process grading rubric PPT and XLS

Great quotes

8 Tips in Taking on School-wide Makerspace Leadership

> # 8: Students are capable of almost infinitely more than we initially expect of them – or they of themselves.
>
> My students' mindsets are shifting towards always trying a new activity, thinking in "prototype" terms, being prepared to make changes to ideas, and expecting "help" in the form of advice rather than taking over. As that happens, I'm seeing kids actually making more progress faster when given less explicit instructions.
>
> For example, as I've mentioned, our 5th graders are designing and laser cutting labels for their new classroom spaces – spaces that just finished construction this summer.
>
> For two of the classes, the classes decided to all follow a single template. In those cases, we designed the template together, I finalized it in Adobe Illustrator, and each 5th grader downloaded the template to modify for their own chosen labels. The students navigated downloading the template with a bit of struggle, and asked for quite a bit of handholding in figuring out how to change the text in the template and make their other personalizations… In a full class period, only a few labels were completed.
>
> For the third class, the 5th graders decided that they wanted a broader variety in their labels, so a template just wasn't really possible… So when their class came to the makerspace to use the computers, their task was more open-ended. So I led them through opening Illustrator, in creating a new file sized for their label designs, and then just told them generally about a few of the tools in Illustrator: shapes, lines, curves, and the selection tool for making changes. Amazingly, that class actually finished more labels than the other classes who had more explicit instructions and templates. One student even completed a quite intricate label involving significant use of the curve tool, and it was her first day on any Adobe product.
>
> This is a trend I've seen more and more as the month has gone on: laser cutting design, simple circuitry, simple robotics, the cute PKers and their boats… The kids can do so much more – and independently – than their classroom teachers and I expect.

Lewis & Clark Elementary School

> Our MakerSpace in the Library Media/Maker Center inspires students to become participatory learners to uncover their talents, needs, and interests by making, producing, solving, creating, collaborating and thinking. Students don't have to be in our school MakerSpace to make, create, or innovate!

Makerspace for Education

The concept of makerspaces in the classroom is grounded in theory and research. These include constructionism, the maker movement, design thinking, and media literacy. These frameworks are all relatively new, and may be unfamiliar to educators of all levels of experience. In order to understand the "whys" of implementing a makerspace, take some time to review the main theories and frameworks supporting this movement and the mechanisms behind them. (*See their Making of a Makerspace link above.)*

Makerspace Architecture

- The space
    - Open, visible to other students & visitors if possible (accommodates before & afterschool programs if possible – parking, access, facilities lock-out)
    - Wayfinding signage outside of the space and inside to identify areas
    - Hard floors (to avoid making messes/stains on carpet)
    - Good lighting with windows if possible
    - Tall ceilings if possible to accommodate large projects
    - First floor access if possible to accommodate delivery of supplies/materials/equipment
    - Ample electrical outlets – including pull-down retractable cords from ceiling if possible
    - WiFi/Network connections
    - Exhaust for laser cutter, painting or other fume-generating tools/activities
    - Sink & drain if possible – good for washing hands and for projects that require water
    - Code compliant entrances/exits
    - Fire extinguishers, sprinklers if required
    - First Aid Kits, Eye wash stations (See safety section above)
    - Sound/music system if possible
    - Lean design principles

- The 'look'
    - Inspires creativity, exploration, DIY/DIT (Do It Together), Colorful
    - Student made/altered environment
    - Wall decorations, murals, logos, informational posters, identity/branding
    - Exhibit/Display space

- Furniture and Infrastructure: Benches, Tables, Stools, Chairs, TV/Projection, Whiteboards, Space Dividers
- Materials, Supplies & Tool Management
- Makerspace Mess Management: vacuums, dust management, brooms, hand brushes, trash cans
- Work in process areas for storage of incomplete projects
- Materials Storage and Recyclables/Adoptions Triage
- Take Aparts
- The Display and Shopping Center Concepts
- Brainstorming, presentation, collaboration, communication teaching/learning spaces

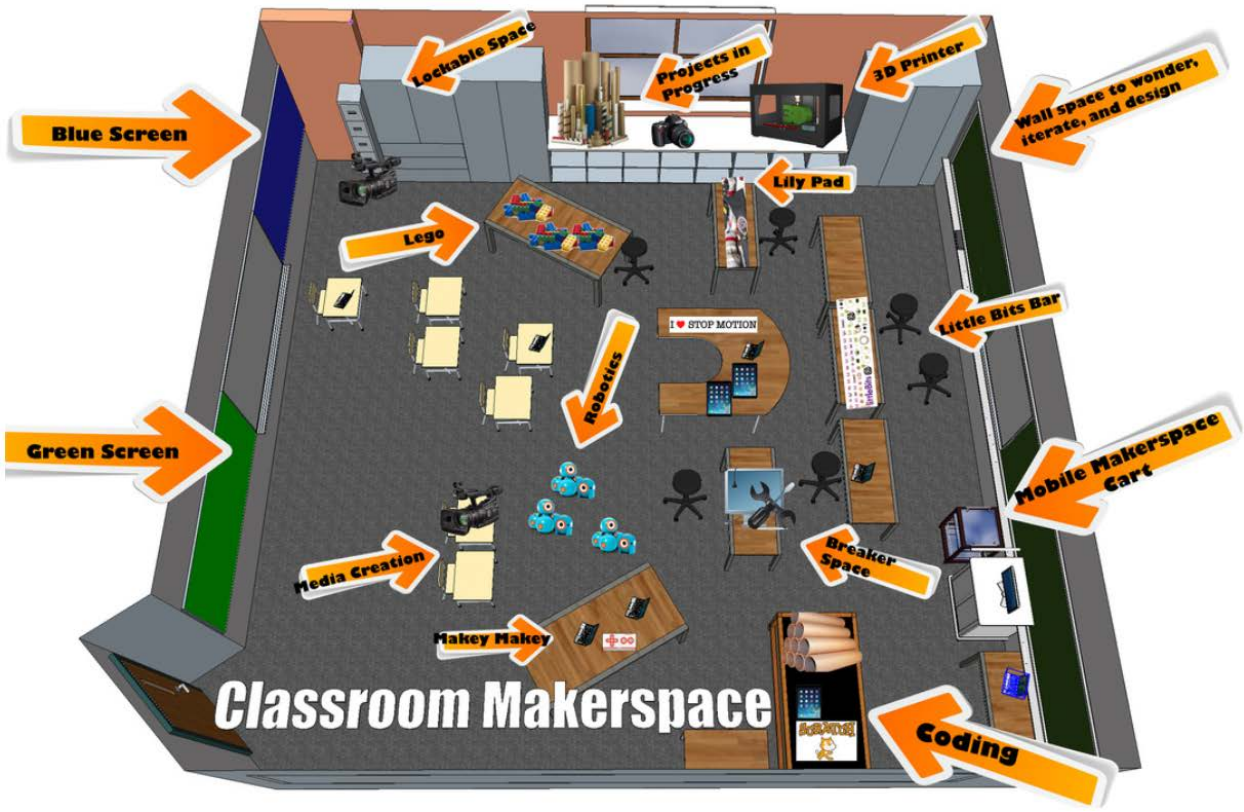


image credit: makerspaceforeducation.com

Making for internal uses and entrepreneurship

- Math manipulatives
- Assistive devices
- Entrepreneurship
- Gifts
- Presentations
- Curricula support, demos, physical artifacts
- Makerspace catalog & e-commerce website

Educator leadership/training

- Makerspace manager/contact person for maintenance, repairs, supplies
- Ongoing Professional Development
- Sponsored Student internships/trainers/maker 'Fellows'
- Competitions

Workforce Development Training/Certifications