Makerspaces: From Elementary Schools to College Campuses
Intros

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Agenda

1. Intros
2. Where did the trend start?
3. Our Benchmarking
4. What do you mean by Makerspace?
5. Designing a Makerspace
6. Case Study
The History of Makerspaces

Where did the trend start?
More recently...

The trend begins
• Make Magazine (2005)
• MIT Fab Labs (2001)
• Economy
• Technology at our fingertips (ipad – 2010)
• Changing role of the library
What do you mean by “makerspace?”
UNIVERSITY/COLLEGE: UNC

SPACETIME: Hill Library Makerspace

R+B MEMBER: Rachel French

DATE: 5/17/2016

USAGE TYPE (COURSE VS. OPEN): Approximately 75% come on their own, 25% with a course. A wide variety of courses collaborate, not just traditional "making." Anyone with a UNC ID can use the space (staff, faculty, students, etc.). Use is first-come, first-served and no appointments are necessary, except for the laser cutter. They actually want to limit demand for the laser cutter as it requires staff and is noisy.

COURSES THAT USE SPACE: An English course's projects were on display, looking into "Interpretive Machines".

# TRAINED STUDENTS: 1000 users by the end of their first year (as measured by people who have taken the orientation course)

TRAINING REQUIREMENTS: Students must take a 30-45 minute safety course. This does not teach how to use the equipment but make sure students know the proper precautions when in the makerspace. Students then just have to scan their ID to enter the space. The makerspace teaches workshops throughout the year that any staff member can participate.

STAFF ROLE AND #: Staff in the makerspace serve as trainers/mentors on the equipment. There is always 1 official staff member but usually more are in the space at any given time. Staff employed by the

# SEATS: 20-seat capacity at one time.

SQUARE FOOTAGE AND LAYOUT: 800 sf; all one contiguous space with various uses designated by furniture. There is a "Staff-only" area, a "Lobby", and the open workspace. The Makerspace has north-facing window to the outdoors, providing connection to street/campus. The whole library-facing wall is glass with easy view into a high-traffic area. "Lobby" space—visitor-facing, this is integral to the success of the makerspace. Much of their business comes from students walking by and seeing into the space. There is a display case of recent work (7 of counter plus 4 shelves). They face the projects inward when the makerspace is open and outward when it is closed to still serve as advertisements. There is also a monitor outside of the space with workshop schedules.

EQUIPMENT TYPES (ON SITE AND RENTABLE): All equipment is mobile except for the laser cutter. The Makerspace offers equipment on-site as well as tech lending to take home that is managed by the library (Arduino, Raspberry Pie, iPads, DSLR cameras). First-come, first-served (just need student ID). Also have "in-house" lending managed by the makerspace. These are items that are small and easily lost or stolen such as light blue beans, flashdrives, thermal printers, galileo, pico boards, Arduino Uno, etc.

- Laptop cart
- (9) 3D printers, Lulzbot is the preferred type. The makerspace always has 2 extras in storage in case one breaks and is not easily repaired.
- 3D printer toolboxes – 1 for each 3D printer with instructions and all supplies needed to service and use the printers.
- Sewing machines
- Soldering equipment
- 3D scanners – both table-top and mobile (students can check these out and take home)
- Shop Vac
- Silhouette Cameo
- Laser Cutter with exhaust to the outdoors with a particulate filter.
- Vinyl Cutter
- Projector + Screen (pulls down front of exterior window)

INFRASTRUCTURE/ELECTRICAL:

- 6 flexible exhaust arms – exhaust required for soldering. It is recommended for 3D printers but not yet required (there is some research coming out on the mal-effects of 3D printer fumes. The makerspace only provides PLA filament which is made from corn/sugar cane and less hazardous. However, users can bring their own filament; ABS is petroleum-based and more hazardous. They may adjust this rule as they go if problems arise.
- Overhead Electrical – aren't happy with the specific design of those chosen. Difficult to plug into apple devices and 3D printers can become unplugged easily. They also have too much length in their cords. Do want to keep the overhead for flexibility and keep plugs off the floor but would look into different options.

FURNITURE:

- There is a display case of recent work (7 of counter plus 4 shelves) in the lobby. They face the projects inward when the makerspace is open and outward when it is closed to still serve as advertisements. There is also a monitor outside of the space with workshop schedules.
- Furniture (in open workspace)
  - (5) 3'x6' tables – not height adjustable but do have two different heights available to allow for desks/visibility during workshops. There are (2) 3'x6' high-top tables and (3) 3'x6' seated-height tables.
  - (12) Chairs – all on wheels. There are 10 tall chairs (2 are along wall dedicated to soldering and to the laser cutter) and 12 traditional height chairs.
- Furniture (in staff/lobby space)
  - 6 lower cabinets/drawers
- Laptop Cart
  - 2 Chairs – 1 tall, 1 regular
- (2) 3'x6' high-top tables
  - (1) 3'x6' seated-height table
- Storage
  - Student storage – students can utilize lockers in 2-week increments. Each have a key code. There are large lockers (approx. 14" x 2") and 34 small lockers (approx. 10" x 1")
  - Supply storage – would like easily accessible storage closet to keep duplicate equipment (such as extra sewing machines needed for workshops but not on a daily basis) and supplies. Do have storage in basement.
- Cabinets – Storage in the room are in lower cabinets and drawers throughout the room. They are working on better labeling systems since items must be known/visible to encourage their use. There is approximately 20 linear feet of cabinets/drawers with useable counter space. There are additional cabinets and drawers with more substantial equipment on top and thus, not useable counter space.

FINISHES (FLOOR, WALLS, CEILING):

- Users only pay for consumables – 3D printer filament by the spool to control type being used.
- Laser Cutter is the only piece of equipment requiring a staff person to operate. Users pay for time and materials. The makerspace only allows materials they choose to be used as some materials can create toxic gases or damage the equipment.

MISCELLANEOUS INFO:

- Hunt Library had the original Makerspace that was more service based. Users would drop off projects and pay for the time and materials used to produce them. It offers more advanced capabilities since projects are created by the staff. The Hill Makerspace is teaching based and mostly free of charge. It opened in June 2015. Other Makerspaces are starting to pop up around campus but are operated by individual departments. There is no central management or parlay of operations. The library Makerspace is considered a "literacy project" to educate students on making and the various tools available. The Makerspace is funded entirely by
Makerspace Type #1

Discovery Lab
Discovery Lab

Characteristics

• Supports short term, spontaneous projects
• Art / crafting supplies
• 3D Printer
• May be a mobile cart
• Lego wall
• Often found in elementary schools, museums, and libraries
• Display space
Discovery Lab

d School K-12 Studio
Stanford
Discovery Lab
Library- North Stafford High School
Arlington, VA
Discovery Lab
Library - North Stafford High School
Arlington, VA
Other things we saw
Makerspace Type #2

Fabrication Lab
Fabrication Lab

Characteristics
- Primary purpose is academic support
- Career Tech / Vocational
- Dedicated staff
- Partnerships with local businesses
- More advanced equipment
- Flexible infrastructure
- Storage!
Fabrication Lab
UNC Hill Library
Chapel Hill, North Carolina
UNC Hill Library
Chapel Hill, North Carolina
Fabrication Lab
Bray Lab, Robotics Lab - Tufts University
Medford, Massachusetts
Fabrication Lab
Plano STEAM
Other things we saw

Stanford

Columbia

NuVu
Makerspace Type #3

Industrial / Manufacturing
Industrial/Manufacturing

Characteristics
- Local companies prototyping
- Product development
- “people first, not equipment first”
- All access 24/7
- Mentorship program/Office hours
- Sometimes called “hackerspaces”
Industrial/Manufacturing
mHub
Chicago, Illinois
Industrial/Manufacturing
Autodesk Pier 9
San Francisco, California
Industrial/Manufacturing
Autodesk Build Space
Boston, Massachusetts
Makerspace Type #4

Co-Working / Incubator
Co-Working/Incubator

Characteristics
- Open to community
- Presentations
- Staff assistance
- Auditorium for selling ideas to sponsors
- Food for purchase/vending
- Paid memberships
Co-Working/Incubator
1871, Merchandise Mart
Chicago, Illinois
1871, Merchandise Mart
Chicago, Illinois
Co-Working/Incubator
Hana House
San Francisco, CA
Co-Working/Incubator

WeWork
New York, NY
Case Study

St. Gabriel’s Catholic School
Austin, TX
Catholic Identity

Social Emotional Learning

Self-Awareness
  - Risk Taking
  - Responsive Classroom

Self-Management
  - Communication
  - Service Learning

Social Awareness
  - Accountability
  - Empathy
  - Digital Citizenship
  - PBL
  - Collaboration
  - STEAM Maker
  - Resilience
  - Differentiation

Relationship Skills
  - Problem Solving
Pre-K 3 - 8th Grade:

Design Thinking, Engineering, Tinkering, Take-Apart
Initiatives

- Innovative Learning
- One-to-One Technology
- STEAM and Maker Ed
- Service Learning

The IPARD Framework

The IPARD Framework represents the student-centered inquiry model in a service-learning project. Prior to the activities in this framework, educators and project organizers have identified student goals and objectives aligned with assessments.
Makerspace: Design Lab

- Student-Centered
- Experiential
- Connection Seeking
Start-Up Spaces

- Differentiated Learning (collaboration, one-on-one instruction, tutoring)
- Modeled after high-tech companies
STEAM Curriculum

Grade level curriculum guides STEAM learning

- Pre-K science unit on energy connection to building instruments
- 4th science unit on adaptations connection to 3-D designing prosthetic hands
- 8th science unit on force and motion connection to building go-karts
Low Tech and High Tech

- Carpentry
- Soldering
- Sewing
- Circuits
- Coding
- Programming
Scheduling

Fall Semester: Reserved 30-45 minutes per week per class with open sign-up

Spring Semester: Online sign-up

After School: Support for teachers

Summer: STEAM Camp for students and PD for teachers
Without **change** there is no innovation, creativity, or incentive for improvement. Those who initiate change will have a better opportunity to manage the change that is inevitable.

**William Pollard**
Nuclear physicist, Episcopal priest, Author, Teacher

**Questions?**

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