MIT Edgerton Center K-12 Makerspace Survey
Summary of Results
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Number of respondents with operating makerspaces: 58

Operations:
- 60% are in public schools, 28% in Independent Schools, and 12% in other environments such as public libraries and community organizations.
- Greater than 70% have been open for 2 years or less, only 8% in operation more than 5 years.
- Over 90% are used for Academic classes. Other significant uses included personal projects (53%) and Competitions (39%).
- Two thirds of the Makerspaces represented in this survey were used primarily for high school grades. The remaining ones had a mix of elementary and middle school student users.
- There were a full range of project types including Robotics, Engineering, Science, Photo/Video, Art, Coding, Carpentry, Theater, Crafts, General Design and Problem Solving, Architectural. No one type of activity stood out.
- During the school week there was a broad range of operating hours with spikes at 1-10 hours and 30+ hours. Afterschool hours were rarely more than 10/week, with evening and weekend hours even more rare.
- During Operating hours, the predominant purpose of the Makerspace was reported as in support of academic classes, with over half reporting at least 60% of operating hours dedicated to academic classes. Student projects and competitions (FIRST, Science Olympiad) were represented but not more than 40% time. Other uses included camps, drop-in time, hanging-out time, special projects from the school or community.
- Makerspaces in this survey were primarily staffed by paid, highly trained staff - defined as being able to fix as well as use the tools. Some assistance was provided by volunteers at various levels of training.
- Greater than 70% of respondents indicated that their Makerspaces [DB1]were used at least fairly well though few were at capacity. This may be due to the fact that most are newly opened. Few are hosting public or private community-building events, (such as special activities, maker parties, or invited guests) with only a third reporting such events held occasionally. Many did comment that they plan to hold community events but are not yet ready in terms of staff, materials, and/or space.
- Physical resources that were most in need were tools and equipment, and simple starter projects/training activities. Other needs included space, materials, staff, operating hours, and ideas for programs.
- Funding was reported to be manageable but not great. Two thirds of respondents stated they were okay financially, with the rest running on a low budget and just getting by.
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Facilities and Layout
- 88% had work space for a 20 student class. Most (68%) had storage for projects as well as materials (80%). Nearly half had a display area. Many used multiple rooms and separated machines in some way, for example dusty/clean, dangerous/safer, and fabrication space/classroom space.

- Most Common powered Hand-tools:
    - Hot glue guns
    - Soldering irons
    - Hand drills
- Other powered hand-tools:
    - Dremel grinder
    - Jigsaw/Reciprocating saw
    - Powered fabric/cardboard cutter
    - Screw Gun/Impact driver
    - Circular saw/Miter saw
    - Grinder
    - Heat gun
- Most Common Bench-top Machines
    - The 3D printer was most ubiquitous at 90%
- Other Common bench-top machines - 1/3 of all respondents had:
    - Laser Cutter
    - Vinyl Cutter
    - Sewing Machine
    - Benchtop Saw (band, scroll, miter, etc)
    - Drill Press
- Less common machines
    - Sander
    - Milling Machine
    - Lathe
    - Embroidery Machine
    - Vacuum former
    - Grinder
    - Screen printer
    - Large format/poster printer
    - Router (Shopbot)
    - Heat/Mug press

Safety and Training protocols

Safety
As expected, Makerspace leaders are concerned with safety have a variety of ways to ensure their makers use the tools and materials appropriately and work in the space safely.
Safety goggles and other protection are required for specific activities as directed by staff. Many Makerspaces have implemented training courses and assessments for students. Methods suggested on this survey:
- Students earn certifications for tools as they complete training for individual tools.
- Proficiency is assessed by a quiz and/or a demonstration by the student
- Students sign safety contracts that are decorated and posted as commitments to safe behavior.
- Permission for use at one Makerspace involves a thumbs-up from the student and a corresponding thumbs-up response from the staff member.

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Training

For Student group leader (teachers, etc.) there is little consistent structure in training – respondents to this survey reported a wide range from low training (users learning on their own) to general training being provided before it is needed. Students training was reported to be predominantly informal, with only 10% requiring a formal demonstration or assessment such as a quiz or a card with stickers to indicate skills achieved. Mostly students were trained before tools were used, though over half the respondents indicated that sometimes students learn the tools on their own. Training videos and posted refresher guides were in the works or wish-list for many.

Educational Environment and Goals

Makerspace leaders overwhelmingly reported that their students:
- like to be there whether or not they are working on a project
- are social with each other
- learn from each other
- feel comfortable asking for help/advice from staff and/or other users

The educational goals that leaders targeted by far include:
- Academic learning
- Problem solving
- Collaboration and Social interactions
- Empowerment and confidence
- Inspiration and awareness of new fields

Interest in students learning technical skills (tools, machines, etc.) was reported as moderate. Leaders of these Makerspaces put a greater emphasis on student engagement, fun, and thinking skills and are not intending that students simply learn the tools.

Biggest Challenges

In addition to clearly reflecting the resource needs (time, funding, space, materials, and tools), the challenges reported included:
- Maintaining the organization of the supplies and cleanliness of the space.
- Scheduling and staffing the space to accommodate everyone who wants to use it.
- Balancing gender participation.
- Finding qualified staffing
- Creating activities and projects that relate to the specific grade-level content and standards.
- Getting teachers on board.
- Getting kids and teachers in the space and understanding that learning can happen and be assessed in different ways
- Finding the opportunity to work with teachers to Integrate projects into curriculum
- Creating training and community resources
- Offering more "maker days"
- Adding to our available technology and projects, and simply getting better at existing things
- It's not "tech-y" enough for my administrators taste. They want to see more robotics, coding and circuitry.
- Keeping old buildings, machines, and networks running
- Making connections for my students between the content and actual engineering design aspects.

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Biggest Rewards

The rewards reported from having a makerspace centered on student enthusiasm, engagement, and empowerment. Responses in full:

- There is an increased value given to building and creating by students and parents, particularly.
- Student engagement
- Watching the kids as the figure things out - we let them explore. We focus on process, not end product so we don't care what the end project looks like - we care that the student thought a lot about it and put in a lot of effort.
- The level of integration of the students who used to have issues of bad academic performance.
- The space is humming at recess with kids pursuing their own projects.
- In the six weeks we've been open, three-fourths of the classroom teachers have used the space for at least one project with their class."
- Seeing kids go from an idea to a finished product. Encouraging a growth mindset where students expect to fail early and have support to achieve their goals.
- All of the "unexpected" but amazing learning/teaching opportunities that occur as the result of this type of learning environment
- Helping students turn their ideas into reality and facilitate success is extremely rewarding. Our mission is to use the FabLab to help the community.
- Watching our students gain confidence, develop grit, and seeing their excitement when they solve an issue. Our students drive our excitement for the maker moment and push us to constantly look for better ways to share in their learning experience.
- School community enthusiasm for the space and the opportunities that it provides.
- Empowering students who didn't know they'd like making. Giving students an alternative to traditional education - tests, essays, etc.
- To have students and faculty use the space in their academic pursuits and realize the benefits for impactful and deeper learning results.
- Students' happiness when they are there and creating something.
- Student enthusiasm is contagious. I love the energy in the room. I love the positive feedback I've gotten from the administration, parents, students, community. Students are getting valuable hands-on experience on new technology that they wouldn't have gotten at our school 2 years ago.
- Student interest and accomplishments
- Our community makerspace lives in a public middle school. Our makerspace helps grow tools and space, for the students and the community.
- Student enthusiasm
- Seeing student enthusiasm for trying new difficult tasks.
- It is student centered, and it empowers the kids who most need it.
- Being a part of student design and discovery. Being a safe and favorite place to be for many students. Empowering students, especially girls, to use tools.
- Seeing students creating on their own using skills that they have learned through the Makery.
- Seeing students persist with a project that they have failed at until they are able to do it.
- Watching the students create and problem solve problems that the adults do not know the 'answer' to.
- Student enthusiasm
- Watching what my students create to solve real-world problems.

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- Seeing the energy and excitement students show as they are inspired by the work they do here. Seeing their collaboration, perseverance, and skill sets develop.
- Helping students create and learn a skill that they can use beyond high school is a great reward. It is also important for them to connect the concept of the library commons with creation and creativity so they can have the capacity to become lifelong library users.
- Looking forward to full capacity
- I love it when a kid who has been trained on the machines in a class walks in for the first time and asks to use one of the machines for a personal project. It's exciting to have inspired and excited them.
- Watching kids solve problems
- Made in USA
- Seeing the excitement of the users in the space.
- Don't have time now to answer this question.
- As I mentioned, we just opened this week. The enthusiasm is there. Students and teachers are excited, we have to continue to provide training and ideas for using the space.
- The students in the school love going to the Makerspace and feel very comfortable in it.
- It is great seeing students learn by doing
- That lightbulb going off - I hope to see ideas transfer from projects to individual driven projects
- Opportunities for students to be creative and learn new skills
- Watching students who are not traditional students succeed

Advice for others who want to start/improve a Makerspace:
Makerspace leaders were enthusiastic in sharing advice. The most common tip was to jump right in and get a space going, but start small and let the students and community guide the growth.

Summary of advice:
- Don't buy all the tools, materials, and equipment you think you'll need right away. Start very small and allow things to develop organically based on student input.
- Have a good budget for supplies and staff.
- Plan for students and teachers training
- Have small projects are planned and ready before students come in
- Build your space by writing grants and recruiting volunteers
- Reach out to the makerspace community with requests for advice and help
- Read online sources. Twitter is a great place for ideas
- Include community stakeholders and student groups in the planning and development
- Visit other makerspaces first to see what they are doing and feel their "vibe". Get advice on what equipment is popular and holds up. Buy based on your physical space and staffing availability.
- Be ready to learn a lot to learn
- Get support from Administration and Staff
- Nobody knows everything. You don't need to be the expert on everything. Find and accept help!
- Publicize your successes and get out the PR!
- Plan for storage
- Get electrical outlets that drop down from the ceiling

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