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Makerspace Culture and Its Impact on Learning

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"Makerspaces are about community. We need to ensure everyone from the community can participate."

—Participant in a Drexel ethnography about makerspaces

CHAPTER 4

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Many library workers want to discuss and reflect on makerspaces. A common issue present since makerspaces in libraries first began revolves around what types of equipment a library makerspace should have. This question often comes up as "What should I buy?" or "What equipment do I need?" or "What should I buy to make my makerspace successful?" Individual library workers who are starting to incorporate makerspaces into their libraries or who are trying to deepen, develop, and reinvigorate their makerspaces want to know what is expected, and this is a valid concern. Which pieces of technology each library's user groups will need depends solely on the community they serve. The answer doesn't involve which one thing you can buy or which piece of technology will help their user base the most. The most important aspect of your makerspace is the community that you create, and the most important resource in a makerspace is the community in that space, along with the employees, volunteers, and users that use it, and how they communicate and collaborate in that space.

As library workers, we can identify the user groups and the services that each library offers those user groups. From there, we can identify their needs. Which user groups is the library meeting or not meeting? How can we attempt to meet their needs? All library workers must think about the user groups they serve and how those users want to create new knowledge and new information and invent ideas. Once we have identified the users

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and their information needs, it becomes easy to understand the resources that they need. The users have information needs and goals that they want to accomplish.

The order in which this happens may not be critical. One can purchase a 3D printer, send out a press release, and find out whom it attracts, then build more services from there. Knowing your users and having an engaged community are the most important resources that you can have to start. From there, those users will establish the priorities that the library ought to provide for the makerspace. Being reflective, responsive, and flexible and iterating the design of the space, especially when it is starting out, will assist in all decisions regarding equipment in the space. Library workers can work with this community and design the space using participatory design to have the users help you decide how to proceed.

Makerspaces are about community. Without users, a makerspace is a collection of pieces of equipment. We like to think they are a space with a 3D printer, but that is just one aspect of a makerspace. Makerspaces are places where a diverse group of individuals comes together to create something new. They have many different experiences, and they solve problems differently from one another. In this makerspace setting, they can share these experiences and techniques to create something new—something that has not existed before.

Making and Identity

Once a community is established, the process of creating and maintaining culture and community will change. As the makerspace attracts new individuals as users come and go, this process of reestablishing a culture and set of norms will need to continue. As this organic process occurs, the culture will need to be continually evaluated and reassessed to make sure that the relationship between the users and the library is positive and that each are working to further the others' goals. In a study of the disparity of users, Kim, Edouard, Alderfer, and Smith reiterate the criticality of building this culture:

> We urge education leaders interested in developing makerspaces to be closely involved and highly intentional in designing the culture they seek to create in a makerspace. Be thoughtful in developing a culture through

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> a diversity of input, including students and other school or organizational community members in planning discussions.[1]

The culture of a library makerspace is critical to the health, knowledge development, and skill acquisition of the communities the librarians serve. As R. David Lankes has posited, the mission of librarians is to facilitate knowledge in their communities. Librarians serve diverse communities, and as such, a makerspace needs to cater to all individuals that the library serves. There are two main aspects to working on the culture of the makerspace: ensuring that the culture allows all individuals to participate and identifying behavioral and cultural norms within the space.

Defining the culture of a makerspace, such as in the example below from Red Deer College, is important to allow all individuals to feel welcomed in the space.

> RDC's maker culture is characterized by makers actively participating in their own learning and discovery through experimenting and tinkering with various technologies, tools, and materials to solve problems and/or create prototypes. Interests range from engineering and design to traditional DIY (do-it-yourself) and arts and crafts. Equipment and tools range from electronics, robotics, 3-D design and printing, and the use of Computer Numeric Control (CNC) tools to arts and crafts supplies. Key characteristics of maker culture are networking, collaborating, and learning from others. The focus is on social and shared learning experiences in areas such as:
>
> - Hands-on experimentation
> - Design thinking
> - 3D design and printing
> - Video and sound editing
> - Photo editing
> - Robotics
> - Product modeling and prototyping
> - Arts and crafts
>
> The enriching and transformative space allows creativity to flourish. Makers are encouraged to collaborate, take risks, think critically, and move beyond formal learning and curriculum.[2]

Defining expectations for staff, volunteers, and users is necessary. Deciding the ground rules for how we work in a space will need to take place. The goal in setting these ground rules and agreements is to decide which behaviors in

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the makerspace will help users learn and develop their projects and expertise. The ultimate goal is to have an environment where any user can obtain skills with emerging technologies, develop prototypes, and create innovations.

Making sure you design the library makerspace to include all users is crucially important. Drexel researchers at the ExCITe Center's Learning Innovation initiative have made many recommendations on this topic.

These researchers completed a study in 2019 on making culture. They investigated thirty K–12 education-related makerspaces and developed some recommendations that are highly applicable to makerspaces.[3]

The researchers define culture as the foundation for all student learning. Within their study they found that gender disparity is an issue and that of the makerspace leaders and managers they studied, 76 percent were men. Furthermore, they found that the individuals in makerspaces experience bias. "Instructors primarily referred to male students as 'geeks,' 'builders,' and 'designers' (never 'boys'), but most frequently referred to female students as 'girls' or even 'helpers.'" The way we talk to users in library makerspaces is really important, and it comes out in subtle ways. The authors of the report discuss how makerspaces promote events and jobs and how other opportunities can be coded for a specific type of person. "This declaration for a specific participant identity presents a potential barrier for broader inclusion in a makerspace. It is evident that explicit language cues used for hiring leadership found their way onto the student recruitment flyers." They did find that the makerspace can help individuals move from a traditional to a makerspace mindset that applies a growth model through exploring opportunities in the makerspace.

They make several recommendations to ensure an inclusive culture, including, "Be thoughtful in developing a culture through a diversity of input, including students and other school or organizational community members in planning discussions." While makerspaces have grown within the presence of libraries, the importance of establishing an open culture is critical to the success of the communities the librarians serve. Think about the individual who identifies themselves as someone who makes things and who feels like they can use a makerspace. The researchers also recommend recruiting inclusively to focus on working on implicit biases in the space, creating events that reflect diversity and different cultural norms, and deciding on projects that can help everyone in the makerspace work for the social good.

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Maker Culture and Its Impact on Safety

Behavioral norms work to maintain a safe environment for the makerspace. Physical safety is one critical aspect. In a truly physically safe makerspace, the goal is to have no injuries. If an injury occurs, employees need to document and report the incident. Training teams to be able to document properly is important for success in this area. In addition, training cannot happen once, but needs to be a repeated practice of discussion. Library workers can learn from other scientific labs to create a system of incident reports, and there are many available online.

Incident reports are clear documentation that establishes who, what, where, why, and how an incident occurred. It also documents the steps that led up to the injury or incident and what steps were taken to make sure that the individual received care.

An example of this could be a burn from a 3D printer. In a safe environment, users would be teaching each other about the safety protocols and monitoring each other to ensure each other's safety. Without proper instruction on equipment use, a user may touch a 3D printer nozzle to see how hot it is. Many makerspace users easily make these kinds of mistakes, especially early in the design of a space. Such mistakes can easily be avoided through training. When library workers know how to respond, and workers openly discuss safety, injuries can be prevented. Holding open, regular, and repeated discussions about safety are exactly what defines the makerspace culture. Library workers will want to pay attention to what they monitor in a space with regards to safety. For example, if someone is running a laser cutter, an employee will need to be present to stop fires from happening and put them out if they occur. Similarly, an employee may want to watch a printer start with a new user and talk to them about the safety issues of the space. All users will readily pay attention to the safety rules and gently talk to one another about ways to protect themselves from injury.

If a burn from a hot 3D printer nozzle occurs, an employee would want to document what led to this injury, who it happened to, and any detailed information about this injury. The employees in the space will want to review each incident to identify what steps could be taken to prevent this injury from happening again. In my experience, the same types of injuries will occur until conversations about safety happen with the teams and users in the space.

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This will involve a structured combination of raising awareness and providing training. When done effectively, library employees will look for individuals who require assistance and be attentive to their needs. Community members will also point out personal protective equipment to one another and be mindful of others' safety needs in the space.

Red Deer College Library has an excellent example of a code of conduct for their makerspace. On the library guide they have published regarding the space they include how to behave in the space and how to document incidents.[4]

In addition to asking that all users report any injuries to the library employees, the guide also states their code of conduct, further establishing the important connection between culture and safety. Their website states:

> This is a space where everyone is welcome and which inspires creativity and collaboration. Some activities will make you think critically, others will turn your thoughts into action.
>
> We support a maker culture where:
>
> - everyone shares responsibility for safety.
> - we help one another and are receptive to feedback.
> - we support one another.
> - innovation is encouraged.
> - positive experiences are created.
>
> This is a space to have FUN, LEARN, be PRODUCTIVE, and work SAFELY.
>
> Please adhere to posted safety and equipment guidelines, report damaged or unclean equipment, and ask questions.[5]

Some makerspaces have safety guidelines that ask that individuals not wear dresses or heels, which is a biased guideline and can be removed from any library rules regarding a space. One can replace that kind of language by stating that one needs "close-toed shoes." The safety guidelines at some libraries are quite inclusive. Others are overly specific in their inclusivity. Some codes of conduct include recommendations for long beards as well as hijabs. Generally, keeping the safety guidelines simple and understandable is the key to success. They will keep individuals returning to the space.

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Examples of this would be to keep "long hair, jewelry, or clothing tied back." It may not be reasonable to ask individuals to remove long garments, but we can recommend that they keep those fabrics out of the way of moving parts.

Outreach in Makerspace Design

Assessing who is and is not using your makerspace is important. This can be done in a variety of ways but always involves strategically identifying underrepresented groups in the makerspace. Underrepresented groups can be defined locally, meaning that you can evaluate the data objectively of who is checking into the makerspace and who is using equipment by using a resource manager software or some other way of tracking who is coming and going. Observation is not an adequate assessment of use, as one must rely on users' self-identification to determine their demographics. Also, no one person can be present at all times in a makerspace but relying on who checks in will help paint an accurate picture of the main demography of users.

Once that has been defined, the makerspace managers or employees can conduct strategic outreach. Outreach events that work best are those that vary in degree of technicality and cultural background, are fun or laid back, and are based on ideas from the group that you want to help establish a feeling of belonging within the space.

Meaningful Making

Once folks have gotten in the door and culture has been set, what are the best practices to coach individuals to make progress in their work? Furthermore, how do you retain them in the space as users? The key here is understanding the needs of the communities that you serve through the makerspace and ensuring that it is easy for individuals to both use the space and learn new skills.

In a recent research study, a group of researchers talk about mindfulness in making. After conducting research using a methodology of interviewing users and employees in makerspaces, Bowler and Champagne came up with a set of questions to enhance user skill sets and help coach them to advance in their work. They found that mindful habits and metacognition helped individuals in the makerspace to identify:

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- What will make me happy?
- Who is my audience?
- What resources do I have and need?
- What will inspire me to give my time and effort to a project?
- What do I know?
- Can I let myself make a mistake?
- How will my creation affect other people?
- What kind of maker am I?

These questions help individuals to develop into users and library employees who serve as mentors in these informal learning environments to work together productively. They assist with the development of a reflective and iterative mindset. Asking such broad questions that focus on metacognition is important to help others understand how what they are making or creating contributes to the community. These questions can also help individuals pause their learning process and reevaluate, which can in turn help them learn and develop new ideas. The authors discuss how this uses the passions and interests of the users to help create structure. Relationships among individuals in the space become learning tools. Methodologies like this one can be adapted to any makerspace and can help encourage users to develop their values in making and innovation.

Methods and Approaches for Creating Equitable Makerspaces

Equity is a value, which the employees in a makerspace can believe in and agree to uphold. Implementing equity in a makerspace requires focus and strategy to make a difference. As with all places of work, when we work with others, we all have inherent biases. These biases cannot infringe on the rights of others. Making gendered comments, for example, including, but not limited to, repeating common stereotypes can create hostile environments for individuals.

An easy way to begin the conversations needed to address different kinds of makerspace biases is to assign Kirwan Institute's Implicit Bias training. Individuals can watch and read these training modules asynchronously. This training can provide a baseline understanding of how to help everyone use

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the space—understanding that everyone comes with biases but that not acting on those biases is important.

Makerspace employees can use these discussions to create a culture in which we work to not make comments about specific groups.

One area where library makerspaces need to focus is on how individuals with accessibility needs can use the space and equipment. The University Design for Learning: Theory and Practice states that when we design with accessibility in mind, we improve the instruction for everyone. Library workers will want to consider taking steps to ensure that everyone, regardless of accessibility needs, can use the space equally.

The University of Washington conducted research on this topic. Their 2015 report, titled "Making a Makerspace? Guidelines for Accessibility and Universal Design," posits, "In creating these innovative spaces we should apply principles of universal design to ensure the spaces, tools, and community are accessible to as many individuals as possible." Furthering the reasons for paying attention to this important makerspace factor, the American Library Association's Core Values of Librarianship lists access first, defined as, "All information resources that are provided directly or indirectly by the library, regardless of technology, format, or methods of delivery, should be readily, equally, and equitably accessible to all library users." The universal design report is comprised of a very clear checklist of items that anyone can review and consider adding in their makerspace. These items include having different kinds of pedals to operate a sewing machine, having a variety of eye protection types to accommodate all users, and ensuring that all pathways are clear and wheelchair accessible. Makerspaces tend to attract large items and clutter, and tables and chairs sometimes become reconfigured into clusters while users are working on projects. The leaders and managers need to make it clear to the staff teams that accessibility is a priority in their space. Teaching individuals how to notice when the space begins to become inaccessible to some users is important. Considering the space between tables is always a struggle in any makerspace, and it is a simple fix to get those reset to a position every night and to check them again at opening.

An example of using universal design in makerspaces can be found at www.washington.edu/doit/making-makerspace-guidelines-accessibility-and-universal-design.

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Process of Student Involvement, Empowerment, and Research

Two types of user-centered design include participatory design and empowerment design. When we invite in users as leaders and work to empower them within the makerspace library, those workers can help users advance their lives. Such workers can also help design a better makerspace. Researcher Richard Ladner writes about the different kinds of empowerment design in an article published by ACM and in the journal *Interventions*. He argues that to help individuals with diverse accessibility needs, the combination of empowerment and participator design will make the greatest change among users of any service, and that these types of design are very powerful. Users help to develop and analyze the services and refine the makerspace.

One way to do this is by having users volunteer on advisory boards; or, if in an academic setting, have them participate directly in the assessment and research of the makerspace. They make recommendations on everything from how the service is running to which pieces of equipment ought to be purchased.

There are several libraries doing this kind of work. Any public library with a teen advisory board already conducts participatory design in their library. One great makerspace example is at San Diego State University.

The San Diego State University Build IT space incorporates a volunteer base to coach and teach others. The users of the space are trained and not paid. They acquire skills and establish norms, helping the library serve up the services in the space. You can find the Build IT at: https://buildit.sdsu.edu.

Working together with the users and potential users of the space is critical to establishing the best and most accessible culture of the library makerspace. Culture is not a one-and-done process. Creating culture is something that must be worked on holistically regularly, especially as a makerspace grows and as new users join the space. Empowering users to help facilitate decisions is important. Users can provide feedback in a number of ways, and it's important for librarians to see the users as partners in navigating and negotiating the space. How meetings take place, along with when and how a tool is used and by whom, can create important tensions—this can happen with both users and the employees.

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Conclusions

The success of your makerspace will depend on your engagement and how you define success, and then on assessing to see if you have met your goals. In all makerspace design, determining the culture of your space will go a long way to make sure that everyone uses your space effectively to meet their goals. If your library already has a strong community of individuals working in the space, it is important to continue to work with them and help new users come into the space and use the equipment. Strong culture can work both ways: to exclude and include. If you design your space and culture so that it can accommodate cultural change based on who enters the space, your culture will continually improve and change to meet the needs of the users.

Perhaps what is most critical for the individuals who supervise and manage the makerspace is to keep a strong communication channel. Giving teams the ability to offer and receive honest feedback will go a long way toward ensuring a long-term strategy to create a successful makerspace culture. How you define success for your makerspace is really up to you and your community's needs. A successful practice will show that a wide variety of users can use the makerspace and create projects.

NOTES

1. Youngmoo E. Kim, Kareem Edouard, Katelyn Alderfer, and Brian K. Smith, *Making Culture: A National Study of Education Makerspaces*, (Philadelphia, PA: ExCITe Center, Drexel University, 2019), https://drexel.edu/~/media/Files/excite/making-culture-full-report.ashx.
2. "Makerspace: Maker Culture," Red Deer College Library, https://rdc.libguides.com/c.php?g=696069&p=4951048.
3. Youngmoo E. Kim, Kareem Edouard, Katelyn Alderfer, and Brian K. Smith "Recommendations," Drexel University, https://drexel.edu/excite/engagement/learning-innovation/making-culture-report/recommendations.
4. "Makerspace: Code of Conduct & Safety Guidelines," Red Deer College Library, https://rdc.libguides.com/c.php?g=696069&p=4950561.
5. "Makerspace: Code of Conduct."

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