AccessEngineering

Making a Makerspace? Guidelines for Accessibility and Universal Design

Many engineering departments, libraries, and universities are launching new initiatives to create makerspaces, physical spaces where students, faculty, and the broader community can gather and share resources and knowledge, work on projects, network, and build. 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.

Universal design encourages the design of space, products, and processes not just for the average user, but for people with a broad range of abilities, ages, reading levels, learning styles, languages, cultures, and other characteristics. Makerspaces foster innovation, and we want to ensure that individuals of all backgrounds and abilities can actively contribute to the design process. We advocate for participatory design (*interactions.acm.org/archive/view/march-april-2015/design-for-user-empowerment*) where individuals from diverse backgrounds bring their unique experiences and perspectives to the design process. This document outlines guidelines, questions, and best practices to consider in creating, retrofitting, or maintaining makerspaces.

Student Voices

Why are accessible makerspaces important, and how do we involve more students with disabilities?

- "Makerspaces are about community. We need to ensure everyone from the community can participate."
- "Makerspaces are often used to help build new assistive technology and increase accessibility; however, many of these spaces and tools remain inaccessible. We need to make sure disabled people can access these spaces and create the products and designs that they actually want."

Planning and Policies

Create a culture of inclusion and universal design as early as possible. During your planning process consider the following questions:

- Are people with a variety of disabilities included in the planning and set-up of the makerspace?
- Are there mechanisms for users to suggest new equipment or request accommodations or adaptations to existing equipment?
- Are there simple mechanisms for users to request assistance or guidance from staff or peers?
- Are there detailed and well structured documents in accessible formats describing the rules and best practices for the makerspace? This can especially be useful for individuals with learning disabilities and those on the autism spectrum.
- Do websites and other publications include pictures of users from diverse backgrounds? Need some pictures? Check out and use some pictures from DO-IT at *www.uw.edu/doit/RDE/photos/*.

Space

An ideal makerspace is a large, central, open space where people can brainstorm, build, and work together on their creations. Adjoining rooms with secure doors can be useful to house specialized tools that require training or to provide a quiet area for individuals to work with less distraction. Flexibility is key in the design of makerspaces. The ability to move furniture and reconfigure the space can maximize accessibility while also assuring the space can be used for diverse projects and initiatives. Makerspaces are often created in unused corners of campus, basements, or older structures. When creating the space, ask

- Are parking areas, pathways, and entrances wheelchair-accessible and clearly marked?
- Are all levels of the space connected via an accessible route of travel?
- Are there high-contrast, large-print signs throughout the space, especially for safety information?
- Are aisles wide and clear of obstructions (e.g., wires) for people with mobility or visual impairments?
- Have safety procedures been considered for students with hearing, visual, or mobility impairments?
- Are power cords and work surfaces clearly marked and accessible for individuals with mobility or visual impairments?

- "Consider hosting a workshop or other event to welcome individuals with disabilities to come and learn more about the space. You could even have a hackathon where participants work together to increase the accessibility and design of your makerspace."
- "With a visual impairment, I create mental maps to navigate spaces. I love that all of the furniture is on wheels to create flexibility, but I also like that a lot of the tools are in fixed spots. I will always know the location of the 3-D printer and laser cutter, even if the space in between changes from day to day."

Furniture

Tables, chairs, and other furniture in most makerspaces are readily movable; creating a flexible and accessible environment. Brainstorming spaces offer alternative sitting environments that may actually be more difficult to navigate in a wheelchair/scooter, with crutches, or by a telepresence robot. Sometimes creative seating options like bean bags or foam blocks are used in makerspaces. Bean bags are comfortable for some, but are roadblocks for others. When considering the furniture for a makerspace, choose variety. Offer different heights, armrests, and surfaces to support a diverse user base. Some additional considerations for furniture include

- Can whiteboards and other tools be reached from a seated position?
- Are adjustable-height tables available?
- Do counters have space beneath for wheelchair users?
- Can the wheels on furniture be easily locked and unlocked?
- Are magnifying lenses and desk lamps available? These are useful for individuals with visual impairments, as well as for anyone working on small scale projects.
- Is there easily accessible storage for projects and supplies?

Ideation, Team, and Meeting Space

Some groups may like to stand during their brainstorming, others may prefer to spread out across the floor. Individuals with disabilities may not be able to use brainstorming or prototyping space that requires individuals to stand.

- Do groups have the freedom and flexibility to make the space work for their team?
- Is there a quiet space that individuals or groups can use? This may be useful for individuals with hearing impairments, with attention deficits, or who are on the autism spectrum.
- Are their multiple ways for users to share their ideas with others? Molding materials may be easier for individuals with visual impairments to quickly "sketch" ideas and share.
- Encourage prototyping early! Creating quick physical prototypes can make it easier to share ideas and get feedback from diverse users.

Tools and Equipment

Many of the new tools and equipment available in makerspaces are increasing accessibility and the ability of individuals with disabilities to build and create. 3-D printers, laser cutters, and other computer-aided design tools are opening up the possibilities for what all people can make. To maximize this potential, the choice and placement of tools in a space can greatly facilitate accessibility.

- Are tools and equipment kept in designated areas? Can they be reached from a seated position?
- Are tools and equipment labeled with large print and braille labels? (Easily created with your 3-D printer or laser cutter!)
- Can both right- and left-handed people use tools?
- Are power cords, including those suspended from the ceiling, kept out of walkways? Are their positions easily adjustable?
- Have you tested software and new tools for accessibility and compatibility with screen readers and other technology? Push suppliers to help make makerspaces more accessible.

In choosing tools and equipment, consider whether the design is accessible to diverse groups.

- **Sewing machines**: Is there a hand-operated or switch-operated sewing machine that can be accessed by individuals who cannot use pedals?
- **3-D printers**: Is the print surface accessible? Are the software and interfaces required to operate the printer accessible with screen-readers and other assistive technology?
- **Laser cutters:** Is the surface accessible for individuals with a disability? Can large or raised labels be added to key buttons or features?
- **Hand tools**: Do you have clear labels and organization for hand tools? Do tools have rubberized grips? Are plastic guards used on all saws or other sharp tools?
- **Electronics**: Is use of fume hoods or smoke absorbers encouraged? Are storage bins for resistors and other components clearly labeled with large print or braille?
- **Rapid prototyping**: Do you have materials that are accessible for diverse abilities? Some may prefer wood and nails, while others may prefer foam, pipe cleaners, or clay depending on their dexterity, strength, and background in fabrication.
- **Computers**: Is assistive technology, including trackballs, alternative keyboards, screen readers, and speech-to-text software, available?

> "Don't underestimate abilities. Ask if someone needs assistance, but don't assume they cannot do it themselves."

Staff, Safety, and Training

Training is also a fundamental component of creating a successful, safe, and inclusive makerspace. A goal of many makerspaces is to reduce barriers so all people can get in, learn, and start creating. The staff and users of a makerspace work together to create a safe and inclusive environment. Some important considerations for safety and training include

- Are training materials and instructions available in multiple formats? Having electronic versions available on a website allows individuals to use screen-readers, magnifiers, or other technology to easily access documentation.
- Are safety signs high-contrast and large print?
- Can all safety equipment, including fire alarms and fire extinguishers, be accessed by individuals who use a wheelchair or have limited dexterity?
- Are there visual and audio indicators for safety and equipment notifications?
- Are safety goggles available in a variety of sizes and styles?
- Is staff trained to assist and provide accommodations for individuals with diverse abilities? Check out our communication hints and other resources from *AccessEngineering* at *www.uw.edu/doit/programs/accessengineering/resources*.
- Are there clear rules and expectations for users to clean up the space and maintain a well-organized environment?

- Do marketing materials for training sessions include information about how to request sign language interpreters or other accommodations?
- Are any training videos captioned?
- Do you have a protocol to follow when a piece of equipment is inaccessible to an individual with a disability? Can they request assistance from staff or other users?

Focus Groups and User Testing

Makers need to test and experiment with their creations. Makers should be encouraged to reach out to diverse users. Challenge makers to consider universal design in their prototyping, and testing. Make universal design and accessibility a part of your culture. Challenge your makers to consider

- Have we received feedback from individuals with a variety of disabilities in our testing?
- How might we solve this challenge for an individual who uses a wheelchair?
- How might our design change to enable an elderly individual or an individual who is pregnant to use our creation?
- How could we adjust our design to be easily used in the dark or for individuals with visual impairments?

Further Information and Resources

- *Could a Child Use Your Makerspace?* by Barbara Klipper at *www.alsc.ala.org/blog/2014/08/could-a-child-with-a-disability-use-your-makerspace*
- *DIYAbility*: Empowering people with and without disabilities to make their world at *diyability.org*
- *Making Space in the Makerspace: Building a Mixed-Ability Maker Culture* by Meryl Alper at *teethingontech.files.wordpress.com/2013/03/idc13-workshop_meryl-alper.pdf*

About AccessEngineering

The College of Engineering and DO-IT (Disabilities, Opportunities, Internetworking and Technology) at the University of Washington lead the *AccessEngineering* project for the purpose of increasing the participation of people with disabilities education and careers in engineering and improve engineering fields with their perspectives and expertise. For more information, to be placed on the mailing list, request materials in an alternate format, or to make comments or suggestions about DO-IT publications or web pages, contact:

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