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Inclusion by Design

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Maker competencies are critical for courses in every discipline. Within the scope of higher education, many individuals have the perspective that makerspaces involve all STEM disciplines, yet making is a crucial aspect of work in the humanities, the arts, education, and the social sciences. Developing an inclusive practice to attract and retain faculty and students from all areas is critical to the success of a makerspace. When we set out to create the MakerLab at Boise State University, we designed the space with inclusion and equity in mind. Through our process of working with history and philosophy faculty through the Maker Literacies grant from the Institute of Museum and Library Services (IMLS), we were also able to help create a new competency incorporating the concepts of diversity, equity, and inclusion so that these principles could be more broadly acknowledged and adopted by other makers.

When designing any space, one must consider the audience. A well-designed makerspace attracts people from diverse backgrounds, disciplines, and identities; when these teams work together, they produce better results. An early question for the MakerLab at Boise State University was "How can

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we design a space to allow individuals from every major to come together and solve problems?" This competency is necessary and should be considered in the design of the space and in the instructional techniques that are used so that diverse makerspace teams can focus on collaboration, teamwork, and problem solving. This process allows transdisciplinary teams to achieve some incredible projects and ideas. This practice of developing an inclusive makerspace is precisely what will connect the humanities, arts, and social sciences into the makerspace. Students from all disciplines can then, in turn, better acquire aptitudes related to equity and inclusion when working in such intentionally designed spaces.

Making should include aspects of certain values to add meaning to the work being accomplished. As mentioned in chapter 2, two of the primary goals of the IMLS planning grant were to test and assess the list of beta maker competencies in a variety of library makerspace settings and to ultimately revise the list of competencies to enable its broad applicability for all library makerspaces interested in integrating curricular development, despite potentially varied sizes, staffing models, equipment selections, geographic locations, and user bases. When we began working with this list of maker competencies, we connected with two faculty members who led assignments in history and philosophy courses. Through the process of developing maker curriculum and comparing the students' learning goals to the competencies list, this grant collaboration at Boise State University led to the development of competency 13: "Be mindful of the spectrum of cultural, economic, environmental, and social issues surrounding making." As discussed in the following text, makers should often consider sustainability, equity of access, and ethics when creating something new, and through the incorporation of this new competency, faculty and librarians are now more cognizant of teaching and emphasizing these important issues.

ABOUT BOISE STATE UNIVERSITY

Boise State University is a doctoral-granting research university in the northwest. Located in Boise, Idaho, the university is situated in an isolated region of southwest Idaho. Boise is unique in Idaho for being a hub of entrepreneurial creativity and recreational diversity.

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ORIGINS OF THE MAKERLAB

Albertsons Library's MakerLab aims to be a radically inclusive space on Boise State's campus with the full spirit of the core values of the American Library Association (ALA) in mind. We aim to support student success by providing access and ensuring equal accessibility to resources for all library users.[1] The library also strives to provide all the resources needed by the community we serve, especially in light of equity, diversity, and inclusion. We hold consultations with our users about creating new information that benefits the public good, while also offering services that aim to do the same. As a result, we try to solve problems within the communities we serve, as ALA's social responsibilities core value states:

> The broad social responsibilities of the American Library Association are defined in terms of the contribution that librarianship can make in ameliorating or solving the critical problems of society; [and in] support for efforts to help inform and educate the people of the United States on these problems and to encourage them to examine the many views on and the facts regarding each problem.[2]

The Albertsons Library MakerLab was established in 2015 with support from the Albertsons Library administration, faculty, staff, and students. The purpose of the MakerLab was to provide access to emerging technologies to all students, staff, and faculty at the university, a facility "open to anyone regardless of their discipline."[3] The intent was to create not only a space for tools but also a place for students to connect and have conversations that lead to the creation of new information—a place "where students can apply things they've learned in the classroom or found through research, experiment and experience failure in an informal setting."[4]

The MakerLab currently provides three primary services: access to a variety of selected technologies, coaching and safety training to use these technologies, and instruction for courses with regard to the makerspace. The instruction program became more robust by working with the Maker Literacies grant team to help establish a formal process of creating instruction plans in different disciplines. Although we had been creating instruction tailored to each instructor's request, the process of using the maker competencies helped us better target and understand some of the goals and outcomes to

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develop in designing the instruction so that we were actively teaching in a transformational style and not solely focusing on the technical aspects of a piece of equipment. Library faculty at Albertsons Library have provided instruction since the inception of the makerspace, marking four years of increasing demands on maker-related instruction; this history of curricular involvement in our space was one of the primary reasons we were selected as grant partners and provided us with a baseline against which to more substantively assess the incorporation of the competencies. Since 2015 the maker instruction program has grown from between three and five instruction sessions to approximately twenty maker instruction sessions per semester. In addition, even more classes use the makerspace to complete their work, though not all request a formal instruction session to complete their assignments.

We worked early on to develop our own homegrown instruction with the collaborations from the other universities in the Make School initiative. Learning from others across the country about how they design instruction was helpful and enabled us to get started. Working with the team at the University of Texas at Arlington (UTA), we were able to further develop our instruction program. Finally, we worked with Stephanie Milne Lane, a graduate student at the University of Washington, to completely revise our instruction program, which is now formalized. We host lesson plans on our website and use the ACRL *Framework for Information Literacy for Higher Education* to design the best possible lesson plans with our faculty. We work with more than thirty faculty members across campus each semester and incorporate new practices and pedagogies as we continually seek to improve our work. This improvement includes growing the number of users, courses, and activities in our MakerLab. The nature of the inclusion by design practice has led to this growth.

MAKER-RELATED PEDAGOGY

The MakerLab has a high degree of faculty involvement, and developing our instructional pedagogy has been essential to developing our maker instruction program. We relied heavily on the book *Meaningful Making* to generate ideas for curricula we can use in any discipline.[5] Ultimately, we found several concepts and ideas that helped guide us: maker assignments are a natural fit with authentic assessment via maker portfolios; experiential learning can

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honor all users' prior learning; tinkering can lead to innovation; and maker conversations facilitate the creation of new information in our communities.

By leveraging existing faculty relationships and by being inclusive and talking about making from an ethical perspective, we were able to connect the makerspace to the social sciences, arts, and the humanities very early on. Working with Dr. Leslie Madsen in the Department of History, we printed a life mask of Abraham Lincoln digitized from the Smithsonian. As our 3D printing capabilities increased, we printed additional life masks. As a result, Dr. Madsen now has a series of these 3D prints in her office, attesting to how much the 3D printing process and our knowledge about it have improved over time. This project led to many positive correlations.

History department faculty felt more empowered to get involved with makerspaces and making in their curriculum. We worked with several other faculty in this department to design assignments with their classes. These experiences led to many encounters with yet more history faculty members, three of whom took part in a faculty learning community we offered on making and makerspaces. They continue to use these skills, competencies, and resources in their courses. As a result, we have been able to reach a broader group of individuals. This extension of service boosts the makerspace community's ability to talk about the historical making experience, especially within the context of a population's creation and use of objects.

Connecting with Dr. Stephen Crowley in the Philosophy Department to model the creation of new information led ultimately to helping him develop a maker assignment on the philosophy of science. The students enrolled in this course worked to re-create experiments performed by scientists. In this process, the students created new information.

In the two pilot courses for the IMLS grant, faculty librarians partnered once more with Dr. Madsen and Dr. Crowley to help facilitate successful maker course assignments. As a result of these professors' careful and thoughtful feedback, we were able to fully develop the competency outlined here:

Be mindful of the spectrum of cultural, economic, environmental, and social issues surrounding making

a. express awareness of diversity and inclusion when identifying unmet needs
b. consider sustainability when making, including upcycling and recycling materials

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c. scrutinize the ethical implications of making

Through the process of reflection, students who engaged in Dr. Madsen's history course (Women in America: The Western Experience) were able to better articulate some of the more nuanced aspects of historical concepts. The students were tasked with studying a pair of shoes from the Idaho State Historical Society's collections; using the information from their investigations, they then created an object that would reveal the history of women in Idaho. This task led them to understand more deeply some design choices. For example, why were certain shoes made with different types of materials at different times? This question helped lead processes of inquiry in the makerspace. By engaging with the space, which had been designed to best serve these students, and by working with the competencies directly, the students had a transformative experience of learning.

Professor Madsen's assignment, entitled "In Her Shoes," required students to develop new and contextualized information regarding the cultural and historical significance of shoes that women wore in different time periods. Students scanned, analyzed, made digital models, and created multimedia projects about their assigned pair of shoes from the historical society's collection. Through the process of working with digital and historical objects, the students created new information, new interpretations, and new understandings about this content. The students made websites, videos, and interactive modules that helped other individuals learn about selected topics. As the students scanned shoes and evaluated and created these multimedia examples through the frame of maker competencies, their understanding increased. The lens of creation is different from that of a traditional paper writing assignment, and, as a result, the learning must be authentic in a different way.

Within this course assignment, students were confronted with issues of context and labels in historical research. What does gender mean in the context of shoes? How were shoes created? Students had to confront a diverse range of opinions and consider the needs of many to understand the greater context. This assignment also led students on a journey of considering the materials that were used in the construction of the shoes, prompting discussions about sustainability and the ethical implications within this context. Some shoes required more expensive and environmentally unsound practices to create, while others used more sustainable practices. Who wore which, and why? What were the purposes of these shoes? At the time of the grant

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pilot, no maker competency comprehensively covered the ethical inquiry that these history students were engaging in—a skill that is certainly transferable beyond the scope of this project; perceiving this omission led us to fill that gap through the creation of competency 13.

Dr. Crowley led his Philosophy of Science students, who came from a variety of backgrounds, on a journey to explore Galileo's inclined plane. Galileo used this item to establish the theory of gravity. Students used their prior learning along with social, environmental, and historical contexts to obtain new information. Because no one knows how Galileo calculated the passing of time in this context, the students had to discuss this mystery among themselves and conduct research, in the process creating their own new versions of this work. In this course, students considered many alternate theories regarding gravity. In the makerspace, they purchased items that would have been available in Galileo's time and built items that they thought would help Galileo understand the theories he wrote about and espoused. The class built a giant ramp and a variety of counting mechanisms to try to measure the speed with which an object went down the ramp. They had to trust one another and honor each other's diverse perspectives within the context of making in order to form a full opinion on this topic. Together, using unique perspectives, they were able to solve the problem for themselves.

In both of these contexts, the students worked together from a variety of backgrounds to use both their experiential knowledge and the content from the course to create new information. Each student considered the ethical issues surrounding science and making and needed to be aware of the perspectives of others throughout the process of creating course deliverables.

In addition, by creating a makerspace that serves everyone, our employee team was able to better serve these students because we were prepared for their nuanced questions. Some traditional makerspaces may cater to groups that are already familiar with making and emerging technology lingo and vernacular; our makerspace, however, has worked with a lot of individuals who are not familiar with emerging technologies at all. In fact, some are slightly resistant to having to learn these new skills and don't understand the applicability or relevance of the makerspace to their course. By working with a range of students, from those who have no familiarity with maker tools to those who visit repeatedly, we grow more nimble and are better able to serve all students. It is especially poignant when our staff can help connect

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student learning in the makerspace to students' previous experiences, as was the case with these two courses.

Just as important, this awareness and valuing of prior knowledge mean it is easier for us to work with individual faculty in departments from all across the campus, not just from STEM-related fields. Ultimately, every discipline creates new information in different ways. Some of our more significant collaborations, outside philosophy and history, have involved education, psychology, and art faculty and students. By being open, creative, and collaborative with the faculty, and by being inclusive of all disciplines, we can set the stage for greater makerspace participation. Partnering with these faculty led to thoughtful discussion regarding maker competencies.

HONORING PRIOR LEARNING

As evidenced by the history and philosophy coursework just described, the MakerLab strives to honor the prior experience of the makers and users of the space, demystifying making and creating a space for failure. As unique spaces, makerspaces have the capacity to lower the barrier for access into STEM and innovation and design principles. When we honor prior learning, we allow a greater number of individuals to access the space.

Individuals often come into the makerspace with course projects or passion projects in mind. They arrive with all their own experiences and knowledge, from times when they have repaired or fixed something and from their expertise in their discipline—the content they acquire in their courses. By honoring their prior learning, the space can become more inclusive, and we can demonstrate that the creators can also embrace this competency in their own work.

There are many ways to foster the concept of prior learning in the makerspace both within traditional instruction methods and informally when teaching. The most important aspect to keep in mind is that folks may already be familiar with the topic you are approaching. It's critical when engaging with learners to ask them what they already know about a topic. It is possible that they have already learned project management or acquired a specific maker skill by working with the same technology, background that can be straightforward. But what about transference? That can be trickier to identify.

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In making, a variety of skills can transfer from other areas. When describing concepts and skills to students, be sure to include other areas of life in which they might have previously encountered a similar concept. These areas can include, but would not be limited to, cooking and baking, working on cars, dealing with health care issues, or any situation that required problem solving. Sharing anecdotal stories regarding the maker competencies allows students to consider their own stories and realize how to apply their past experiences to a newer, possibly unfamiliar technology or creative process.

CULTURALLY RESPONSIVE AND INCLUSIVE PRACTICES

As stated earlier, the foundations of the maker competency to consider the "spectrum of cultural, economic, environmental, and social issues surrounding making" ought to be included in the design and practices of a makerspace itself, not just thought of as a learning outcome for the courses run within the space. With this integration in mind, leaders of makerspaces can consider adopting certain culturally responsive and inclusive practices while teaching others how to do the same.

Biases, stereotype threats, and generalizations are important first factors to consider. How are individuals within a makerspace engaging in professional communication? Are some individuals being referred to by name or by some other quality? How are we talking to individuals? Professionalizing the makerspace by encouraging employees to consider their own biases and then challenging them through training programs is essential to helping students learn to do the same. At Boise State University, we ask each employee to take the seven-day Bias Cleanse focusing on racial, gender, and anti-LGBTQIA+ biases offered by the Kirwan Institute for the Study of Race and Ethnicity at The Ohio State University and to participate in trainings offered by the Gender Equity Center on campus. Customer service should be broadly understood as dealing with others using the "platinum rule": treating others as they want to be treated while adhering to the safety policies of the makerspace.

A primary goal of librarians in higher education makerspaces should be to connect with faculty in all disciplines, whether or not those disciplines or faculty members consider "making" an essential activity. Each major and discipline works to create new information; therefore, many assignments rely on the use of maker competencies and maker-type emerging

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technologies to discover new information. Librarians can help bridge that gap in understanding.

Who is actually using your makerspace? Makerspace employees are responsible for evaluating who is using your space and for reaching out to those individuals who are not represented in the space. In higher education, it is possible to obtain data showing who is using equipment and to request de-identified data to evaluate this information.

Honoring experiential learning is key to showing individuals that they are already makers. Our makerspace hosts many conversations about who a maker is (all humans are makers) and what "making" is. These conversations take place both formally and informally. Individuals who walk into the space with their projects naturally discuss making as well as their projects. Most projects are inspired by personal interests and passions, which tend to be tied to individual identities and experiences. Because of the nature of this kind of making, the conversations about who can sew (anyone) and who can code (anyone) happen regularly. In addition, we lead these conversations in instruction sessions to meet an instructor's objective to demystify making or to help learners see themselves as people who tinker or make.

Every instruction session requires that we ask students to define a makerspace as a group. We then ask the group to define *making.* One key anchor activity involves discussing the most recent thing students made. Some learners made coffee or a sandwich, whereas others worked on a project for their house or their car. Individuals who work full time often have an example of something they made in their working environment, such as a nurse who improvised a splint to improve the pain level of a patient. By exploring and broadening the definition of *making,* individuals unfamiliar with the makerspace will begin to see themselves on a greater trajectory of making. They can see that with each thing they made, they followed steps, failed, and learned something new. They can describe how they consulted with others—coworkers, family members, and friends—to garner new information about the solution they are implementing. If a person can make a new cookie recipe, that person can 3D print. It's all about following a series of steps, gaining comfort with ambiguity, and trusting the community of learners in the makerspace.

When trying to find something to 3D print, some users might discover that their culture is not represented on the website Thingiverse or other, similar

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open-source repositories. A critical practice is to teach maker employees how to facilitate the creation of new items that can be 3D printed or created out of vinyl or cut with a CNC and then shared through these repositories. Our student employees do this all the time—and teach others how to do so. As we teach our employees how to design, they then teach all the users how to do so. Individuals who are designing to meet their needs represent the best-case scenario for making in higher education contexts.

CONCLUSION

At the root of this work, practices must match the method of delivery and content. If we are going to teach undergraduates how to design ethically, we must also design ethically. When we do so, we are able to transform the kinds of learning that can take place within a library makerspace. In addition, through the processes of designing this instruction and designing the makerspace, we can create an inclusive environment in which individuals from all backgrounds, majors, and disciplines can work together. In diversity of thought we can find promising work to transform our theories and find solutions to common problems.

NOTES

1. "Access to Library Resources and Services," American Library Association, http://www.ala.org/advocacy/intfreedom/access.
2. "Core Values of Librarianship," American Library Association, http://www.ala.org/advocacy/intfreedom/corevalues.
3. Tracy Bicknell-Holmes, "Why a MakerLab in a Library?," Boise State University, https://library.boisestate.edu/wp-content/uploads/2017/06/Why-a-MakerLab-in-a-Library.pdf.
4. Bicknell-Holmes, "Why a MakerLab in a Library?"
5. Paulo Blikstein, Sylvia Libow Martinez, and Heather Allen Pang, *Meaningful Making: Projects and Inspirations for Fab Labs and Makerspaces* (Torrance, CA: Constructing Modern Knowledge Press, 2016).

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