
MAKER LITERACIES FOR ACADEMIC LIBRARIES

INTEGRATION INTO CURRICULUM

EDITED BY KATIE MUSICK PEERY



ALA
Editions
CHICAGO | 2021

alastore.ala.org

KATIE MUSICK PEERY is the director of the UTA FabLab at the University of Texas at Arlington Libraries. She provides leadership related to the development, management, and continuous improvement of the lab. Katie has published on diversifying makerspace student hiring and best practices for makerspace training to increase the inclusivity, impact, and efficacy of makerspaces on a college campus. Her grant work and research are primarily focused on integrating maker literacies into higher education curricula.

© 2021 by Katie Musick Peery

Extensive effort has gone into ensuring the reliability of the information in this book; however, the publisher makes no warranty, express or implied, with respect to the material contained herein.

ISBNs

978-0-8389-4806-4 (paper)

978-0-8389-4984-9 (PDF)

978-0-8389-4986-3 (ePub)

978-0-8389-4985-6 (Kindle)

Library of Congress Cataloging-in-Publication Data

Names: Peery, Katie Musick, 1988- editor.

Title: Maker literacies for academic libraries : integration into curriculum / edited by Katie Musick Peery.

Description: Chicago : ALA Editions, 2021. | Includes bibliographical references and index. | Summary:

“This book inspires, empowers, and teaches librarians, makerspace staff, and faculty how to integrate their institution’s makerspace into curriculum”— Provided by publisher.

Identifiers: LCCN 2020019596 | ISBN 9780838948064 (paper) | ISBN 9780838949863 (ebook) |

ISBN 9780838949849 (pdf) | ISBN 9780838949856 (kindle)

Subjects: LCSH: Makerspaces in libraries—United States. | Maker movement in education—

United States. | Academic libraries—Relations with faculty and curriculum—United States.

Classification: LCC Z716.37 .M34 2021 | DDC 025.5—dc23

LC record available at <https://lccn.loc.gov/2020019596>

Cover design by Kim Thornton. Text design by Alejandra Diaz in the Kepler Std, Filson Soft and Protipo typefaces.

© This paper meets the requirements of ANSI/NISO Z39.48-1992 (Permanence of Paper).

Printed in the United States of America

25 24 23 22 21 5 4 3 2 1

CONTENTS

Preface, vii

Acknowledgments, xi

1 | Teaching and Learning through Making

Gretchen Trkay and Rebecca Bichel

1

2 | Who, What, and Why

Contextualizing Maker Literacies for Academic Libraries

Martin K. Wallace

15

3 | Transforming from an Ad Hoc Service to an Integrated Curricular Component

Tara Radniecki

35

4 | Inclusion by Design

Amy Vecchione

53

5 | Collaborative Curriculum Codevelopment for Studio-Based Learning

Morgan Chivers

65

| v |

alastore.ala.org

**6 | Design and Implementation in a Project
Management Course**

Jaime Cantu

87

7 | Establishing an Ecosystem of Makers on Campus

Sarah Hutton

109

**8 | Faculty Collaborations to Put Maker Competencies
into Course Assignments**

Anna Engelke, Bryant L. Hutson, Kelly A. Hogan,
Joe M. Williams, Darianne Mizzy, Megan Plenge, Jennifer Coble,
Josh Corbat, and Mark McCombs

127

APPENDIXES

Appendix A: Beta List of Maker Competencies, 143

Appendix B: Maker Competencies (Revised December 2018), 147

Bibliography, 157

About the Contributors, 159

Index, 163

PREFACE

As makerspaces become increasingly ubiquitous, many librarians have questioned the value these technologies bring to the library setting—is this just a fad to entice new users, or does engaging with these tools offer a true educational advantage? Even those librarians who believe in the benefits of makerspaces often then wonder, “What role could I possibly have in contributing to the success of such a space?”

Throughout the initial ideation, creation, and expansion of the Maker Literacies program, the University of Texas at Arlington (UTA) Libraries and FabLab staff consistently encountered these same questions, both for themselves and among makerspace staff at other university libraries. From the outset, we wanted to quantify the impact that academic library makerspaces were having on student learning, underscoring the anecdotal success stories we all hear with data which justified the programs and spaces that so many have worked to create. How best to accomplish that goal, as well as how best to share and encourage the adoption of such practices at other institutions, has been as experimental as any project that is created within the makerspace itself.

We set about our task by first drafting a rough set of maker-based competencies—transferable skills we believed students were gleaning by designing, fabricating, failing, and iterating in our collaborative, non-discipline-specific space. Internally, several faculty members partnered with us to pair selected competencies with their courses’ learning outcomes, which we then assessed through pre- and post-assessments and faculty feedback. Although course integration of makerspaces occurs at many institutions, those programs often exist outside the library, are discipline-specific, or do not focus on assessment of the learning taking place. As this program evolved, we also wanted to specifically highlight the significant role librarians play in bridging the gap between the subject-based content students acquire in their courses and the interdisciplinary knowledge they can gain through making.

Thanks to external funding from the Institute of Museum and Library Services (IMLS), we have been able to continue to test and grow this program at other diverse institutions across the nation. More information about the origins of this program, accounts by all our partner institutions from the initial IMLS grant—Boise State University; the University of Massachusetts Amherst (UMass Amherst); the University of Nevada, Reno (UNR); and the University of North Carolina at Chapel Hill (UNC-Chapel Hill)—and the perspective of a faculty member are included within this book.

Through this work we have discovered that many librarians and makerspace staff members desire to establish a program like Maker Literacies at their institutions but are underprepared to partner with faculty in the curriculum development process; teaching and instructional design skills are often not emphasized in the traditional library school program, putting librarians at a disadvantage when working with faculty members who are also subject matter experts in their field. In other cases, space, staffing, or material constraints, or a lack of administrative support, impede progress or limit how courses can operate within a space.

Maker Literacies for Academic Libraries: Integration into Curriculum is written to inspire, encourage, educate, and empower librarians, makerspace staff, and faculty who are interested in integrating their makerspace into curriculum but have encountered difficulties such as those just noted or just aren't sure how to get started. The accounts within this book are presented by libraries serving a wide variety of user demographics, partnering with courses from a range of subjects, and all offering disparate equipment selections—no two are exactly alike, and each encountered its own unique challenges and successes in bringing this program to reality.

Collectively, UTA and our four partner academic library makerspaces from the first IMLS grant project have successfully refined and expanded the list of maker competencies to inclusively cover the broad scope of transferable skills that students obtain through maker-based course assignments. As a continuation of that work, UTA, UNR, and UMass Amherst are now partnered with seven other institutions, including UNC-Chapel Hill, to revise and improve standardized rubrics for each of those competencies to better assess student learning outcomes. We will also develop and host an immersion program for academic librarians and makerspace staff to impart best practices learned through this grant work, allowing participants to become curriculum design and assessment leaders within their local spheres of influence.

The future outcomes of the Maker Literacies team will continue to be shared broadly and openly for others to adopt and adapt. The assessment tools, immersion curricula, and analyses of student learning data will join the lesson plans and other resources currently found on the Maker Literacies website (library.uta.edu/makerliteracies) as they are developed and finalized. Our hope is that this book, along with these resources, will serve as an enduring, evolving, and impactful resource for librarians engaging in the maker movement for years to come!

—KATIE MUSICK PEERY



Teaching and Learning through Making

Gretchen Trkay and Rebecca Bichel

At the turn of the millennium, many people were pondering the future of academic libraries. *Library as place* had become a catchphrase as learning commons became ubiquitous in university libraries, but was there a future for libraries as providers of individual work and collaborative spaces? Some thinkers in the profession saw special collections and archives as the future of academic libraries, claiming that a library's value rested in its unique holdings and the access it created to that content. And a few of us had begun to consider the opportunities presented by the freedom of not being anchored to the role of collection caregiver. Could we become entrepreneurs, with our product being services and programming that strengthen students' expertise in and confidence with using cutting-edge tools to create and problem solve? The FabLab at the University of Texas at Arlington (UTA) Libraries represents one outcome of such a venture.

This chapter will explore, from two different perspectives, how UTA Libraries became a hub for making and maker-based education over the past six years. Specifically, Rebecca Bichel, the dean of UTA Libraries, will discuss the inception of our unique take on a makerspace and the intended

goals at its creation, and Gretchen Trkay, our department head for Experiential Learning and Outreach, will explain how we approached actualizing a strategy for integrating making into curricula.

INSPIRATION AND INNOVATION IN LIBRARIES

BY REBECCA BICHEL

In 2012 UTA Libraries began an almost wholesale rethinking of what a library can be and, more specifically, what our library should be. Inspired by library thought leaders urging the profession to be bold, we began with a comprehensive data dive to uncover hidden needs and opportunities. We looked to qualitative and quantitative data that reflected university growth, enrollment, and library use but made certain to couple this research with bold ideas as well as best practices.

In the past decade, makerspaces in libraries have moved from exceptional to expected. Visionary Lauren Smedley created the first makerspace in a library in the United States at Fayetteville Free Library in New York State in spring 2011. In summer 2012, as UTA Libraries began planning for a pilot makerspace on the first floor of its Central Library, the DeLaMare Science and Engineering Library at the University of Nevada, Reno became the first academic library in the United States to make the leap to offering 3D services, including printing and scanning, to all students. Tod Colegrove, then director of the DeLaMare Library, noted that the maker service “takes the library’s support of the learning and research missions of the University to a new level—beyond simple information exchange and consumption into knowledge-driven creation.”¹

A visitor to these makerspaces would find as much unique as shared, but what resonated most powerfully with me was a bold vision for technology as a tool to enable library users to move from consumers to creators. Dr. David Lankes, whose scholarship focuses on new librarianship, gave a revolutionary speech in October 2011 inciting librarians to act—to look to the future and not the past. His stated task was to “radicalize librarians.” Lankes demanded we throw away the notion that we are in the “book business” in favor of the more noble goal of facilitating the creation of knowledge.² This vision inspired UTA Libraries to advantage neither the present nor the past in our thinking about how to empower our students to create.

This call for action was echoed by library influencer Brian Mathews in his 2012 white paper exhorting librarians to abandon a fixation on incremental enhancements to existing services, which he labeled as the quest for ever “better vacuum cleaners,” in favor of bold ideas, transformative change, and attention to the user’s real needs.³ He noted, “Our jobs are shifting from doing what we’ve always done very well, to always being on the lookout for new opportunities to advance teaching, learning, service, and research.” This perception resonated with UTA Libraries as we sought to integrate ourselves broadly in the university’s ambitious new strategic plan rather than identify with a library-only mission. Both the university’s and the Libraries’ strategic plans prioritized enabling students as creators. From that strategic-level priority, a series of actions were planned, beginning with the creation of a cross-disciplinary makerspace, to be called the UTA FabLab, and retooling our instructional programs toward hands-on learning.

Creation of the FabLab

The UTA FabLab opened in 2014 and was the first MIT-affiliated FabLab in a university in Texas. The vision was that graduates with experience in the UTA FabLab would have a competitive advantage in the marketplace through their development of a rich toolkit of professional, creative, and technological skills.

In developing the UTA FabLab, we visited about thirty makerspaces across the country, some in libraries, but most not. Some on college campuses, some membership-based, and some open to the community. Our focus was not on what technology or tools to include but on best practices in developing a customer base, sustainability models, and the service model for each space.

A common phenomenon we saw in academic libraries was makerspaces housed in rooms with minimal hours and little, if any, dedicated staffing. These spaces sometimes seemed to exist more for the function of checking off an “Innovative Spaces in Libraries” bucket list item than for serving local needs. In addition, we saw many examples of the mini-me phenomenon—a space that was a mimicry of another makerspace or based on a published how-to list with no local conversation or data gathering.

We also saw incredible makerspaces. Some of our favorites were a makerspace in a public school in which the students had real ownership and there was a vision for equipping the students with life skills; a makerspace

in a public library staffed entirely by volunteers but filled with locally grown innovations for local needs (e.g., using a digital studio to host indie music recordings); and a community makerspace in a socioeconomically depressed neighborhood that humbled us with how much the organizers accomplished with scraps and donations.

From these visits we fundamentally learned that if we wanted to build an indispensable makerspace and programming, we needed to be authentic to our students' needs and closely aligned with the core values and goals of our university and libraries. Although we have heard from other libraries about underused makerspaces, that was never the case at UTA. From its soft opening in 2014 as an eight-hundred-square-foot beta space through its expansion into an eight-thousand-square-foot facility, the UTA makerspace has been well used. I believe that this success came as a result of a series of carefully crafted decisions during the planning phases and continued responsiveness to the observed needs of our community.⁴

FabLab Design Strategies

The UTA FabLab space and programming were designed with specific goals that drove decision-making. For example, we wanted to attract a broad cross section of students, rather than a specific discipline or class level. So we strategically located the FabLab on the first floor of our Central Library, highly visible as soon as you enter, and not in a specialized library. We wanted students to feel welcomed, so the space is adjacent to our café, is completely open to the library (no walls), and has a mix of study tables and worktables. We wanted diverse students across disciplines to use the space, so we made a policy decision to aggressively recruit student employees across disciplines, gender identities, and ages, recognizing that this diversity requires a resource investment in building the technical skills of many student employees. Absent this policy, we would likely be staffed almost entirely by male engineering students.

The following strategic decisions governed design:

1. *The development of the UTA FabLab was one outcome of a broad strategic goal related to creation.* The FabLab was never a one-off or just a space. It was developed as a distinct public services department with associated staffing and services. The department was later partnered with

another new department, now called Experiential Learning and Outreach, responsible for developing course-integrated and independent learning opportunities grounded in a philosophy of experiential learning (discussed later in this chapter).

2. *The UTA FabLab would be available for any student.*

No class-only limits. Because there was a shortage of learning labs, we heard strong faculty advocacy that the FabLab be limited to classes only and curricular use, excluding walk-in students or recreational projects. We instead advocated to stakeholders the value of a makerspace open to all students across majors. We want students in the makerspace anytime, exploring and applying their creativity. We design pop-up programming to encourage this aspect.

No limits to majors or class levels. Because there was a shortage at UTA of labs in which engineering and architecture students could work, initially there was an external expectation that those majors would be our target audience. Instead, we aggressively market to all colleges. Knowing that student employees bring their friends and classmates to visit the FabLab, our goal is to have student employees from each college on campus in our long semesters. We also promote the space as STEAHM (Science, Technology, Engineering, Arts, Humanities, and Math), not STEM.

Value and work for diversity. Because UTA is one of the most diverse universities in the country, we knew we wanted to help overcome the inherent barriers of a perceived STEM space to non-STEM majors and women.⁵ Our recruitment strategy for student employees reflects this goal. We recruit faculty across disciplines to engage with their students in the FabLab. This outreach has included disabilities studies, English, art, math, education, modern languages, engineering, architecture, biology, philosophy, theater, broadcast communication, and history. I am proud that though leadership for discipline-specific fabrication labs is overwhelmingly male, our director is a woman and a librarian.⁶ This key position sets the tone for our commitment to diversity.

3. *Embrace risk-taking and play.* Much of the equipment is not heavily mediated. Rules are limited, such as those for safety. Like the rest of the library,

we want the students to feel ownership of the FabLab. They are *not* our guests. This is their home. That means they have spaces to relax, explore, and experiment. Skilled technicians and student employees help students craft solutions for complex class assignments as well as make fantastical figures for tabletop games. At the same time, although mentors are available, we celebrate failure as an inherent, valuable learning experience. Another way we enable risk-taking and play is by subsidizing costs significantly. Students pay for the consumables we provide (comparable to paying to print or photocopy) but not for use of the equipment.

4. *Build a full-time staff with technical expertise.* Most library makerspaces are staffed by student employees or volunteers or one staff member, often with other assignments. The UTA FabLab has five full-time staff in addition to our student employees. The two technicians were recruited for their deep technical expertise, and an artist with an advanced degree (MFA), experience creating with maker technologies, and curriculum development and teaching experience but without an MLS was hired as a FabLab librarian. The Libraries received zero new positions for the FabLab, so we repurposed empty lines from other roles.
5. *Minimize barriers to access.* We want students to see the FabLab immediately upon entering the Central Library and to feel welcomed to enter and explore. The space has a casual, industrial design—cement floors, tables hand-crafted from pipe and wood, and colorful balls with retractable electrical cords suspended from the ceiling. There are no walls enclosing the space other than clear glass doors to contain the shop room, and study tables and computer-use tables are purposely integrated to encourage a mix of uses. The space includes a large sectional and other soft seating, as well as oversized bar-height tables. We selected a furniture style inspired by community co-working spaces to encourage collaboration and entrepreneurship. The UTA FabLab is adjacent to our café, and food and drink are welcome anywhere in the makerspace, with the exception of our shop room where they would pose a safety risk.

The goal for UTA was never simply to build a makerspace. We knew we needed to build a dynamic space to support our strategic goal of supporting creation, but we also needed paired services, programming, and outreach that

integrated making within the curriculum as one of the university strategies to enhance student academic and professional success.

The UTA FabLab is unique as a library makerspace because it was conceptualized as an integrated space with a broad vision of what a modern, twenty-first-century research library should be. We made a decision to offer campus leadership focused on student creativity, innovation, and entrepreneurship; developed a strategy to advance that leadership goal; and created a makerspace as one element of that mission. Our next step was to redesign our instructional program to draw upon the tools and expertise offered via the FabLab to transform our teaching from active to experiential learning.

INNOVATION IN TEACHING AND LEARNING PRACTICE

BY GRETCHEN TRKAY

In direct response to our strategic imperative to be a hub for experiential learning and creation, the Libraries built the UTA FabLab, a space in which students could engage in both self-directed and guided inquiry and creation. This strategic imperative promised the UTA community access to “a transformative environment that fosters learning through reflection, design, creativity, experimentation, and innovation.”⁷ The FabLab provided that space and service model, and students quickly began to engage in self-directed learning, but we struggled to identify a sustainable strategy for curricular integration and programming. Although FabLab staff worked with faculty to devise new course assignments, the original strategy to partner in this work with the Libraries’ subject liaisons failed.

In 2013 UTA Libraries initiated a comprehensive reorganization. Until that point, subject librarians had been asked to do what subject librarians had always done—consult with students and faculty, provide bibliographic instruction, give input about collections, and occasionally work the reference desk. The new vision included the creation of an outreach and scholarship department. Members of this department would continue to have responsibility for traditional subject librarian activities but would add new layers of expertise, with an emphasis on scholarly communication and hands-on learning.

As is not uncommon in a perpetual beta environment, sometimes you try things and they just don’t work. Our library staff had a mixed reaction to focusing on creation as a primary library function. A few staff members

were excited about the makerspace and became early evangelists. Some were open but concerned about sustainability with limited resources and how staff would develop technical skills. And some rejected the concept of a library role beyond information access and preservation. Many of our subject librarians were overwhelmed with the substantive shift in what they were being asked to achieve.

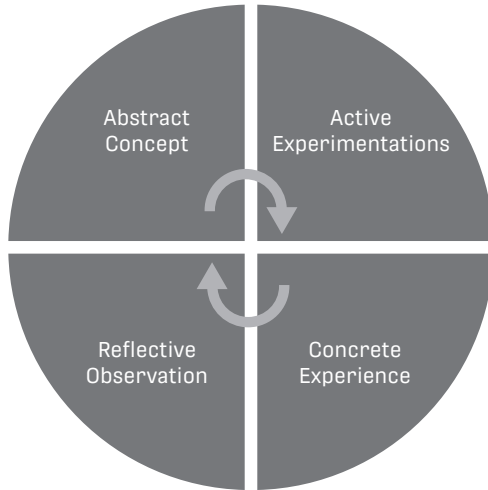
The reality of working within the context of a makerspace is that it requires a set of competencies different from what many librarians have been trained to do.⁸ Rather than emphasizing mastery of academic subjects, information retrieval, and evaluation, those librarians engaged in makerspaces require dispositions that embrace collaboration, adaptability, and learning on the fly, along with such hard skills as program development, grant writing, technology literacy, and a deep grounding in the application of learning theory. The Libraries had not effectively laid the foundation for all our liaison librarians to engage in this new type of librarianship. The closest correlation to the dispositions and skills just listed was found in our librarians who had been heavily involved in teaching and learning and in undergraduate student engagement activities. One of these librarians, who had been initially hired as a first-year-experience librarian and then transitioned into a position as an interim codirector for the FabLab (and who also happens to be the editor of this book), was hired as the full-time director of the FabLab. Within a year of that hire, I, a former information literacy librarian, was tasked with creating a new department for which integrating making into curricula would be among its primary responsibilities. My approach to accomplishing this task was to take what I knew and find a way to apply this knowledge and experience in support of empowering students as creators.

Experiential Learning as a Pedagogical Frame

Experiential learning is an educational model predicated on students learning by reflecting on doing.⁹ The experiential education ecosystem includes high-impact practices such as project-based learning, problem-based learning, service learning, undergraduate research, and study abroad.¹⁰ Experiential curricula make it possible for students to pair and apply subject-based learning with transferable skills. Essential to these curricula are reflective exercises during which students are encouraged to synthesize their experiences with

FIGURE 1.1

Kolb's experiential learning cycle



Source: Derived from David A. Kolb, *Experiential Learning: Experience as the Source of Learning and Development* (Englewood Cliffs, NJ: Prentice-Hall, 1984).

prior knowledge, draw conclusions from the experience, and connect new knowledge with potential future applications (figure 1.1).

Our new department, Experiential Learning and Undergraduate Research (later changed to Experiential Learning and Outreach), embraced experiential learning as its preferred mode for teaching and learning because that model is student-centered and student-specific. Grounded in students' experiences and their individualized reflection, experiential learning allows for those with differing initial knowledge bases to achieve similar growth trajectories, even if they do not ultimately land in the same place. The reflective nature of experiential learning also makes room for the inclusion of instructional strategies that support transferability. Kuglitsch illustrates this feature in her discussion of low and high road transfer within the context of information literacy.¹¹ Specifically, library educators can develop instruction during which students start by exploring a technique or idea (active experimentation and concrete experience) followed by connecting this exploration to other concepts and contexts (reflection and abstract conception), techniques Kuglitsch refers to as “hugging” and “bridging.”

Maker-Based Competencies

Experiential learning is broader than making alone, but the first goal for the Experiential Learning and Undergraduate Research Department was to develop structure and programming for curricular integration of making and low barrier to entry opportunities for guided exploration. Creating a concept for how the department would hire and train librarians and staff, engage with faculty, collaborate with our partners in the Libraries' FabLab, and develop curricula that bridge subject-based learning and transferable skills was our first task. The most profound experience that I had as a librarian was attending the Information Literacy Immersion program presented in 2005 by the Association of College and Research Libraries (ACRL) and the subsequent application of what I had learned to my teaching and learning practice. I had successfully fostered collaborations with faculty by using the ACRL's *Information Literacy Competency Standards for Higher Education* as a tool for mapping what the Libraries could provide to faculty members' goals for students' disciplinary learning. Just as information and digital literacies bolster libraries' position as a hub for teaching transferable and transdisciplinary skills, my thought was that by defining maker literacy as a concept, the Libraries would be able to more easily talk to faculty about the applicability of making outside STEAM disciplines. I made the decision that the Libraries would develop competencies that helped define the transferable skills students could gain via making. Before we even began trying this approach as a strategy, I had dreams of creating a national immersion program that would provide librarians engaged with making what information literacy immersion had provided me.

Simultaneous with this decision, ACRL approved the *Framework for Information Literacy for Higher Education*, an effective argument that information literacy, rather than being a set of transdisciplinary skills, had theoretical significance outside disciplinary contexts. This shift in how academic libraries were thinking about information literacy gave me pause about whether maker-based competencies were the right approach to creating structure for our work with faculty. It is fair to argue that reliance on competencies to define concepts such as design thinking, information literacy, and the like can be perceived as reductionist, but what the Libraries needed was a bridge for conversation and collaboration with subject faculty that resulted in incorporating the learning of complex, maker-based transferable skills into subject-based curricula. When thinking about the integration of making

into courses, I felt that we needed to reflect on something concrete, something not unlike Kolb's experiential learning cycle (see figure 1.1), before we would be in a place to articulate an abstract concept of making equivalent to ACRL's *Framework*.

An additional consideration was whether pursuing goals that resulted in assessment of student learning in makerspaces was antithetical to fostering a home for maker culture. Many argue that makerspaces should only be used for informal learning and that by applying structures of formal academic environments, student learning will be stymied. It is a fair critique. Our position was that guided, course-integrated making with measurement of student learning was only one of a multitude of ways in which students could engage with iterative design and creation. Additionally, if course assignments, activities, and instruction are carefully structured, there is still room for students to explore, invent, and problem solve as part of their process. Ultimately, we felt that for libraries to be able to meet the expectations of university administrations, we needed to show return on investment through usage statistics and tangible evidence of student learning.

Getting the Work Done

With a path forward in mind, we needed to determine how best to staff a department that would not work specifically for the makerspace but for which one of the primary responsibilities would be integrating making into courses. Due to the nature of our library, our first hire would also be responsible for traditional subject liaison duties. Our strategy was to hire a librarian who was trained in a discipline that would easily pair with design thinking and creation and who demonstrated excitement about the opportunity to develop some foundational competencies and tools for curricular integration of making. Martin Wallace was hired as UTA Libraries' new Maker Literacies librarian and liaison to the College of Engineering. His first task was to pull together a team of subject faculty and FabLab staff to create a beta set of maker competencies that we could use to test course integration and assessment of learning on a local level. This endeavor will be discussed in greater detail in the next chapter, but the team's expected outcome was the development and testing of the competencies so that we would be prepared to apply for a planning grant from the Institute of Museum and Library Services (IMLS)

National Leadership Grants for Libraries program that would fund testing of the competencies at different college and university library makerspaces throughout the country. UTA Libraries was awarded this grant in 2017, and we continue to work with partners nationally to refine and build on our initial work to integrate making into academic coursework.

THE PRESENT AND FUTURE

BY REBECCA BICHEL AND GRETCHEN TRKAY

UTA Libraries' Experiential Learning and Outreach Department continues to expand its work. The trajectory of our work includes curricular integration of both fabrication and digital-based making, pop-up experiential learning opportunities intended for beginning makers, maker-based curriculum and professional development for K–12 audiences, and the development of virtual reality health sciences educational platforms. In partnership with the FabLab, UMass Amherst, and UNR, we received a 2019 IMLS National Leadership Grants for Libraries project grant (LG-17-19-0126-19) to create a national networking and professional development immersion program intended to prepare other librarians to integrate making in courses and assess student learning. Specifically, this grant will fund the development and testing of rubrics for each of the maker literacy competencies discussed in this book. Faculty, librarians, and makerspace staff will be able to apply these rubrics to student artifacts as a direct assessment of student learning and development of maker-based skills. Additionally, the IMLS National Leadership project grant will fund the creation of an immersion program for librarians and library makerspace staff at other institutions. This program will be offered both in person and through an asynchronous, digital platform. All lesson plans, assessments, and course materials created as part of both IMLS grants are available with Creative Commons licenses for reuse and adaptation by others (library.uta.edu/makerliteracies). Our intent is to create an ever-growing repository of curricula as a resource for educators worldwide.

UTA Libraries continues to expand its support for its ultimate goal: to empower students as creators through teaching and learning. The FabLab, the Experiential Learning and Undergraduate Research Department, and the Maker Literacies program were the first expressions of this goal, but the future includes a plan to expand the space available for students to engage

in creative activities. The concept is to dedicate the entire first floor of our Central Library to creativity across disciplines. Students will be able to develop mastery using cutting-edge technologies, adding robust digital creation technologies to the fabrication tools currently available in the FabLab. Our vision is to provide an immersive, technology-rich environment in which students, including K–12 students in nearby schools, can engage as creators, facilitated by librarians and staff committed to experiential learning.

NOTES

1. “DeLaMare Science and Engineering Library First in Nation to Offer 3D Printing Campuswide,” *Nevada Today*, July 19, 2012, <https://www.unr.edu/nevada-today/news/2012/3d-copier>.
2. R. David Lankes, “Killing Librarianship” (keynote speech, New England Library Association, Burlington, VT, October 2, 2011), <https://davidlankes.org/rdlankes/Presentations/2011/KillLib.htm>.
3. Brian Mathews, “Think Like a Startup: A White Paper to Inspire Library Entrepreneurialism” (2012), <https://vtechworks.lib.vt.edu/handle/10919/18649>.
4. Katie Musick Peery and Morgan Chivers, “Intentionally Cultivating Diverse Community for Radically Open Access Makerspaces” (white paper, International Symposium on Academic Makerspaces, Stanford, CA, 2018), <http://hdl.handle.net/10106/27574>.
5. “Campus Ethnic Diversity: National Universities,” *U.S. News and World Report* (2019), <https://www.usnews.com/best-colleges/rankings/national-universities/campus-ethnic-diversity>.
6. Youngmoo E. Kim, Kareem Edouard, Katelyn Alderfer, and Brian K. Smith, *Making Culture: A National Study of Education Makerspaces* (Drexel University, ExCITE Center, 2018), <https://drexel.edu/excite/engagement/learning-innovation/making-culture-report>.
7. *Plunging Forward: The University of Texas at Arlington Libraries 2020 Strategic Plan*, <https://rc.library.uta.edu/uta-ir/handle/10106/25818>.
8. Kyungwon Koh and June Abbas, “Competencies for Information Professionals in Learning Labs and Makerspaces,” *Journal of Education for Library and Information Science* 56, no. 2 (2015): 114–29, doi:10.12783/issn.2328-2967/56/2/3.
9. David A. Kolb, *Experiential Learning: Experience as the Source of Learning and Development* (Englewood Cliffs, NJ: Prentice-Hall, 1984).
10. Jay W. Roberts, *Experiential Education in the College Context: What It Is, How It Works, and Why It Matters* (New York, NY: Routledge, 2016).
11. Rebecca Kuglitsch, “Teaching for Transfer: Reconciling the Framework with Disciplinary Information Literacy,” *portal: Libraries and the Academy* 15, no. 3 (July 2015): 457–70.

INDEX

A

- academic libraries, 17–18, 21
- academic makerspaces
 - Maker Literacies program, vii–ix, 26
 - visits to, 3–4
- access, 6
- ACRL
 - See Association of College and Research Libraries
- Adame, Christine, 29
- additive fabrication, 106
- Advanced Digital Design and Fabrication (ADDFab) Lab, 114
- Afrofuturism course (English 2303) course, 28
- air quality sensor project, 120
- ALA (American Library Association), 55
- Albertsons Library MakerLab at Boise State University
 - conclusion about, 63
 - culturally responsive/inclusive practices, 61–63
 - inclusion, design for, 53–54
 - maker-related pedagogy, 56–60
 - origins of, 55–56
 - prior learning, honoring, 60–61
- Alexander, Amanda
 - as faculty beta tester, 155
 - on Maker Literacies Task Force, 22, 70–71, 154
 - Technology in Art Education course, 28, 72–73
- ambassador for studio arts education
 - ideas about, 75–78
 - Morgan Chivers as, 84–85
- American Library Association (ALA), 55
- American Society for Engineering Management (ASEM), 88
- art
 - DeLaMare Library's IMLS Maker Competencies grant project, 40, 41
 - Emerging Technology Studio (Art 4392) course, 28, 73–75
 - FabLab, 69
 - maker competencies incorporated into, 42
 - makerspace at UNR Library for, 36
 - studio arts skill-building/assessment, 67–68
 - Technology in Art Education (Art 4365) course, 72–73
 - See also studio-based learning
- ASEM (American Society for Engineering Management), 88
- assessment
 - digital fabrication homework methods/results, 103–107
 - in Engineering Project Management course, 92, 100–107
 - of experiential learning assignments, 74
 - interview questions for end-of-semester faculty reflection, 140
 - of learning in makerspace, 51
 - Maker Literacies program's approach to, 78–79
 - of student design/making process, 136
 - of student learning, 27–28, 32
 - studio arts skill-building/assessment, 67–68
 - tools for measuring SLOs, 148
- Association of College and Research Libraries (ACRL)
 - Framework for Information Literacy for Higher Education*, 56

- Association of College and Research Libraries (ACRL) (*cont'd*)
- Information Literacy Competency Standards for Higher Education*, 23–24, 147
 - Information Literacy Immersion program, 10
- audience, 53–54
- Austin, Amy, 83–84
- B**
- backward design, 148
- barriers, 6
- Be A Maker (BeAM), UNC-Chapel Hill
- description of, 128
 - maker education specialist, 130
 - QEP/Maker Literacies project, development of, 129
- Beastcam, 115
- Beck, Estee
- courses of, 28
 - as faculty beta tester, 155
 - on Maker Literacies Task Force, 22, 154
- Beebe, Kathryne, 82–83
- Benyu, Janine, 110
- beta competency 1 (“Identifies the need to invent, design, fabricate, build, repurpose or repair some ‘thing’ in order to express an idea or emotion, or to solve a problem”)
- benefit of incorporating into course, 137
 - Beta List of Maker Competencies, 143
 - incorporation into courses, 139
- beta competency 2 (“Applies design praxis”)
- benefit of incorporating into course, 137
 - Beta List of Maker Competencies, 143
 - biology course making assignment for, 134
 - course design and, 141
 - integration into courses, 139–140
 - in math course, 130, 132
- beta competency 3 (“Demonstrates time management best-practices”), 141, 143
- beta competency 4 (“Assembles effective teams”)
- assessment of homework assignment, 101–103
 - Beta List of Maker Competencies, 144
 - competency overestimations for, 104
 - faculty learning community and, 141
 - geology course making assignment for, 133–134
 - incorporation challenge, 135
- beta competency 5 (“Employs effective knowledge management practices”), 144
- beta competency 6 (“Assesses the availability of tools”), 133, 144
- beta competency 7 (“Assesses the availability of materials”), 133, 144
- beta competency 8 (“Demonstrates understanding of digital fabrication process”), 144
- beta competency 9 (“Understands many of the ethical, legal, and socioeconomic issues surrounding making”), 145
- beta competency 10 (“Employs safety precautions”), 145
- beta competency 11 (“Transfers knowledge gained into workforce, community, and real-world situations”), 145
- Beta List of Maker Competencies, 143–145
- beta maker competencies
- “Assembling Effective Teams” homework assignment, 101–103
 - benefits of incorporating into courses, 136–138
 - Beta List of Maker Competencies, 143–145
 - in courses, discussion/implications, 138–142
 - “Demonstrates understanding of digital fabrication process,” 103–107
 - for Engineering Project Management course, 100
 - incorporation into courses at UNC-Chapel Hill, 127, 128–129
 - incorporation into courses, challenges of, 134–136
 - incorporation into courses with existing making assignments, 133–134
 - with learning outcomes, rubric criteria, assignments, 131–132
 - Maker Competencies (Revised December 2018), 147–155
 - Makerspace Leadership and Outreach course and, 122
- bias, 61
- Bias Cleanse, 61
- Bichel, Rebecca
- information about, 159
 - Tara Radniecki and, 25

- “Teaching and Learning through Making,” 1–13
- BIM (Building Information Modeling), 119
- biology course
- benefits of competencies/making, 137
 - challenges of incorporating competencies into, 136
 - making assignment for, 134
- biomimicry, 110
- Boardman, Bonnie
- as faculty beta tester, 155
 - Introduction to Industrial Engineering (IE 1205), 28
 - on Maker Literacies Task Force, 22, 154
- Boise State University (BSU)
- Albertsons Library MakerLab, 53–63
 - Bias Cleanse for employees of, 61
 - faculty beta testers at, 154
 - information about, 54
 - Maker Literacies program, viii
 - partnership with, 26
- brainstorming
- in Engineering Project Management course, 92–94
 - on integration of maker competencies into courses, 139
 - by students/Wranglers at UNR, 43, 44
- Brown, Afrienne Maree, 110
- Building Information Modeling (BIM), 119
- C**
- Cantu, Jaime
- “Design and Implementation in a Project Management Course,” 87–108
 - Engineering Project Management (IE 4340) course, 79–80
 - as faculty beta tester, 155
 - information about, 159
- Canvas module, 46
- Casadonte, Dominick, 18–20
- case studies, 30
- CC (Creative Commons) license, 32
- challenges
- of assessment of student learning, 27
 - of DeLaMare Library makerspace, 36, 42–45
 - of incorporation of maker competencies into courses, 134–136
- change management system, 97
- Children’s Literature in Elementary and Middle Schools (EDUC 567)
- assignment rubric, 131–132
 - maker project in, 130
- Chivers, Morgan
- “Collaborative Curriculum Codevelopment for Studio-Based Learning,” 65–85
 - on grant writing team, 25
 - information about, 159
 - on Maker Literacies Task Force, 22, 154
- class-only limits, 5
- Coble, Jennifer
- as faculty beta tester, 155
 - “Faculty Collaborations to Put Maker Competencies into Course Assignments,” 127–142
 - information about, 160
- Colegrove, Tod, 2
- collaboration
- Digital Media Lab/College of Education, 115–116
 - with faculty for FabLab integration into classes, 71
 - with faculty in MakerLab, 60
 - for QEP/Maker Literacies project, 128–129
 - teams, assembling effective, 101
 - UNC-Chapel Hill’s team-based approach, 142
 - See also* curriculum codevelopment for studio-based learning
- “Collaborative Curriculum Codevelopment for Studio-Based Learning” (Chivers), 65–85
- College of Education, 115–116
- Commonwealth Honors College at UMass Amherst, 118–119
- competencies
- See* beta maker competencies; maker competencies
- Complex Movements, 110
- concept phase, 91, 92–94
- connection, makerspace culture of, 125
- consultation appointments, 46
- consultation area, 49
- context, in historical research, 58–59
- control, 90

- Cook, Gregory Scott
 - Emerging Technologies (Art 4392) course, 28, 73–75
 - as faculty beta tester, 155
 - on Maker Literacies Task Force, 70–71
- Corbat, Josh
 - as faculty beta tester, 155
 - “Faculty Collaborations to Put Maker Competencies into Course Assignments,” 127–142
 - information about, 160
- cost, 90
- course assignments, maker competencies in
 - assessment rubric, 131–132
 - benefits of competencies/incorporating making, 136–138
 - challenges of competencies/incorporating making, 134–136
 - discussion/implications of, 138–142
 - faculty reactions to maker competencies, 129–130
 - incorporation of competencies into courses with existing making assignments, 133–134
 - incorporation of competencies into courses without existing making assignments, 130–133
 - overview of, 127
 - Quality Enhancement Plan/Maker Literacies project, 128–129
- courses
 - curriculum design with maker competencies, 148
 - DeLaMare Library’s IMLS Maker Competencies grant project, 40–42
 - Designing with 3D CAD and DIM (BCT 420), 119
 - Digital Media Lab’s collaboration for support of, 113
 - Engineering Project Management (IE 4340) course, 79–80
 - example courses from Maker Literacies pilot program, 26–31
 - History of the Book (HIST 4332) course, 82–83
 - Honors Discovery Seminar, Adventures in 3D Printing, 118–119
 - maker competencies incorporated into, faculty on, 138–142
 - Maker Literacies program requirements, 31–33
 - Makerspace Leadership and Outreach (SPP 597M), 120–122
 - Mathematics in the Middle Grades (EDML 4372), 80–81
 - Spanish Culture and Civilization (SPAN 3311), 83–84
 - Technology in Art Education (Art 4365), 72–73
- Creative Commons (CC) license, 32
- creativity
 - active cultivation of, 76
 - maker competencies related to, 150–151
 - makerspace culture of, 125
- critical path, 149
- Crowley, Stephen
 - exploration of Galileo’s inclined plane, 59
 - as faculty beta tester, 154
 - MakerLab course creation, 57–58
- Csallner, Christoph, 28, 155
- cultural artifact, 82–84
- culture
 - culturally responsive/inclusive practices for makerspaces, 61–63
 - makerspace culture of, 125
- curriculum
 - design with maker competencies, 148
 - Digital Media Lab, curriculum integration, 118–122
 - Digital Media Lab staffing and, 112–113
 - Maker Literacies program requirements, 31–33
 - for maker-based competencies, 10–11
- curriculum codevelopment for studio-based learning
 - ambassador for studio arts education, 75–78
 - conclusion about, 84–85
 - Emerging Technologies (Art 4392), 73–75
 - Engineering Project Management (IE 4340), 79–80
 - FabLab, expansion of, 69
 - History of the Book (HIST 4332), 82–83
 - Maker Literacies Task Force, 70–71
 - Mathematics in the Middle Grades (EDML 4372), 80–81

- project success/student learning of new skills, 65–66
 - Spanish Culture and Civilization (SPAN 3311), 83–84
 - studio arts skill-building/assessment, 67–68
 - Technology in Art Education (Art 4365), 72–73
 - work beyond pilots, 78–79
- D**
- dandelion metaphor, 110
 - data collection/validation methods, 108
 - DeLaMare Science and Engineering Lab at the University of Nevada, Reno
 - challenges for makerspace, 42–45
 - conclusion about, 50–51
 - IMLS Maker Competencies grant project, 40–42
 - new service model, 45–50
 - prior service/training model, 37–40
 - student use of, 35–36
 - 3D services of, 2
 - Deming, W. Edwards, 87, 88
 - design
 - Designing with 3D CAD and DIM (BCT 420), 119
 - ethical design, 63
 - FabLab design strategies, 4–7
 - of makerspace for inclusion, 53–54
 - phase of Project Management course, 91, 95–96
 - Technology in Art Education (Art 4365) course, 72–73
 - “Design and Implementation in a Project Management Course” (Cantu), 87–108
 - design praxis, 41, 42
 - See also* beta competency 2 (“Applies design praxis”)
 - design thinking, 129–130
 - Designing with 3D CAD and DIM (BCT 420), 119
 - de-skilled art, 66
 - digital fabrication
 - beta competency related to, 100
 - Emerging Technologies (Art 4392) course, 73–75
 - homework methods/results, 103–107
 - Morgan Chivers’ familiarity with, 71
 - student survey about, 101–102
 - Technology in Art Education (Art 4365) course, 72–73
 - 3D printing at Digital Media Lab, 113–115
 - Digital Media Lab (DML)
 - campus needs assessment, 111–112
 - College of Education, collaboration with, 115–116
 - conclusion about, 125
 - curriculum integration, 118–122
 - as dandelion, 110
 - development of, 110–113
 - as ecosystem, 109–110
 - Makerspace Leadership and Outreach course for UAE students, 122–125
 - outreach strategies within campus/surrounding communities, 117
 - staffing, 112–113
 - 3D printing at, 113–115
 - disposition, 153
 - diversity
 - in competency 13, 57–58
 - FabLab design for, 4, 5
 - Dunning-Kruger effect, 67
- E**
- ecosystem
 - Complex Movements’ natural model, 110
 - Digital Media Lab as, 109–110
 - Digital Media Lab, development of, 110–113
 - outreach by Digital Media Lab, 117
 - Emergent Strategy* (Brown), 110
 - Emerging Technology Studio (Art 4392) course
 - description of, 73–75
 - Maker Literacies pilot program, 28
 - photo of, 29
 - emotions, 138
 - Engelke, Anna, 127–142, 160
 - engineering
 - engineers as makers, 89
 - FabLab use by engineering students, 69
 - makerspace at UNR Library, student use of, 35–36
 - Wranglers, training for, 38–39
 - Engineering Project Management (IE 4340) course
 - assessment metrics, 100–107

Engineering Project Management (IE 4340)

- course (*cont'd*)
 - collaborative curriculum development for, 79–80
 - conclusion about, 108
 - overview of, 88–89
 - project management, overview of, 89–90
 - semester project, 91–99
 - stage-gate process, 90–91
 - theory, need for, 87–88

English course, 28, 30

equipment

- acquisition of, 49–50
- of DeLaMare Library's makerspace, 37–38
- knowledge underestimations at pre-assessment, 107
- student survey about knowledge of, 101–102
- studio arts skill-building/assessment, 67–68
- for 3D printing at Digital Media Lab, 113–115
- user training about, 47–48

errors, 97

“Establishing an Ecosystem of Makers on Campus” (Hutton), 109–125

experiential learning

- assignments, assessment of, 74
- honoring in makerspace users, 62
- as pedagogical frame, 8–9
- in studio arts education, 76, 77, 78

Experiential Learning and Outreach

Department

- experiential learning as mode for teaching/learning, 9
- maker literacies for academic libraries, 17–18
- Maker Literacies program, beginning of, 69
- responsibilities of, 5
- work of, 12

Experiential Learning and Undergraduate

Research Department, 10–11

experiential learning cycle, 9, 11

F

FabApp, 28–29

FabLab

See UTA FabLab

fabrication

See digital fabrication

faculty

- on benefits of competencies/making, 136–138
- DeLaMare Library's IMLS Maker
 - Competencies grant project, 40–42
- example courses from Maker Literacies
 - pilot program, 26–31
- FabLab assignments from, 69
- feedback from, 24
- interview questions for end-of-semester
 - faculty reflection, 140
- maker competencies in courses,
 - discussion/implications, 138–142
- maker competencies in courses with
 - existing making assignments, 133–134
- maker competencies in courses without
 - existing making assignments, 130–133
- maker competencies, reaction to, 129–130
- Maker Literacies program requirements
 - and, 31–33
- Maker Literacies project at UNC-Chapel Hill, 128–129
- on Maker Literacies Task Force, 21–22, 70–71
- MakerLab maker instruction program, 56–60
- makerspace librarians connecting with, 61–62
- at UNC-Chapel Hill, 127
- “Faculty Collaborations to Put Maker Competencies into Course Assignments” (Engelke, Hutson, Hogan, Williams, Mizzy, Plenge, Coble, Corbat & McCombs), 127–142
- faculty learning community (FLC), 141–142
- Fayetteville Free Library, New York, 2
- feedback
 - about Maker Literacies program, 33
 - on benefits of competencies/making, 138
 - on maker competencies, 24
 - for students from teaching assistants, 134
- final product, 98–99
- “fire hose” approach
 - to introduction to FabLab, 82–83
 - for Spanish Culture and Civilization course, 83–84
- FLC (faculty learning community), 141–142
- fossils, 41–42
- Framework for Information Literacy for Higher Education* (ACRL), 10, 56

G

Galilei, Galileo, 59
 Gantt chart, 97
 gatekeepers, 91
 gates, 90–91
 geology course
 benefits of competencies/making in
 courses, 138
 DeLaMare Library's IMLS Maker
 Competencies grant project, 40, 41–42
 incorporating competencies into,
 challenges of, 134, 135
 making assignment for, 133–134
 students/Wranglers, 43–44
 Glazier, Jocelyn, 155
 global community, 122–125
 goals, 11
 Golob, T. F., 100–101
 grants
 DeLaMare Library makerspace, challenges
 for, 42–45
 DeLaMare Library's IMLS Maker
 Competencies grant project, 40–42
 IMLS grant for Maker Literacies program,
 24–26
 Maker Competencies and the
 Undergraduate Curriculum planning
 grant, 36
 for Maker Literacies program, 30
 gravity, theory of, 59
 group work, 135

H

hack, 149
 history course
 “In Her Shoes” assignment for MakerLab
 students, 58–59
 MakerLab instruction, 57, 58
 History of the Book (HIST 4332) course, 82–83
 Hogan, Kelly A.
 “Faculty Collaborations to Put Maker
 Competencies into Course Assignments,”
 127–142
 information about, 160
 homework
 Assembling Effective Teams, 101–103

digital fabrication homework methods/
 results, 103–107
 for Engineering Project Management
 course, 100

Honors Discovery Seminar, Adventures in 3D
 Printing, 118–119

Horowitz, A. D., 100–101

Hutson, Bryant L.

“Faculty Collaborations to Put Maker
 Competencies into Course Assignments,”
 127–142

information about, 160

Hutton, Sarah

“Establishing an Ecosystem of Makers on
 Campus,” 109–125

as IMLS grant partner site coordinator, 154

information about, 161

I

IMLS

See Institute of Museum and Library Services

“In Her Shoes” assignment, 58

inclusion, 57–58

“Inclusion by Design” (Vecchione), 53–63

inclusive makerspace

culturally responsive/inclusive practices,
 61–63

design of, 53–54

MakerLab, origins of, 55–56

maker-related pedagogy, 56–60

prior learning, honoring, 60–61

*Information Literacy Competency Standards for
 Higher Education* (ACRL)

maker competencies list modeled on,
 23–24, 147

maker-based competencies and, 10

Information Literacy Immersion program, 10

Institute of Museum and Library Services
 (IMLS)

DeLaMare Library's IMLS Maker

Competencies grant project, 40–42

for DeLaMare Library's makerspace, 38–39

grant for Maker Literacies program, viii, xi,
 24–26, 30, 153

grant for MakerLab at Boise State
 University, 53

- Institute of Museum and Library Services (IMLS) (*cont'd*)
- grant for UTA FabLab, 11–12
 - IMLS grant team, 154
 - Maker Competencies and the Undergraduate Curriculum planning grant, 36
 - National Leadership Grant, 12
 - National Leadership Grants for Libraries, xi, 24–26, 153
- institutional review board (IRB) approval, 33
- instruction
- at Albertsons Library MakerLab, 55–56
 - maker-related pedagogy at MakerLab, 56–60
- interdisciplinarity
- Digital Media Lab's focus on, 115
 - in maker culture, 75, 76
- interview questions, for end-of-semester faculty reflection, 140
- Introduction to Industrial Engineering (IE 1205) course
- description of, 30
 - Maker Literacies pilot program, 28
- IRB (institutional review board) approval, 33
- IRB of Record, 33
- J**
- jargon, 148–149
- K**
- Karbhari, Vistasp, 21
- Kenan Science Library (KSL)
- maker competencies consulting sessions with, 130
 - QEP/Maker Literacies project training, 129
- Kirwan Institute for the Study of Race and Ethnicity at The Ohio State University, 61
- knowledge management, 74
- Kolb, David A., 9, 11
- Kribs, Christopher, 80–81, 155
- Kuglitsch, Rebecca, 9
- L**
- labels, 58–59
- Lane, Stephanie Milne, 56
- Lankes, David, 2
- laser cutters
- DeLaMare Library's IMLS Maker Competencies grant project, 40, 41
 - of DeLaMare Library's makerspace, 35, 37, 39
 - equipment acquisition for makerspace, 50
- leadership
- Makerspace Leadership and Outreach (SPP 597M), 120–122
 - peer-led workshops at DML, 111–112
- learners, 17–18
- learning
- assessment of student learning, 27
 - experiential learning as pedagogical frame, 8–9
 - innovation in teaching/learning practice with FabLab, 7–8
 - in makerspace, assessment of, 51
 - prior learning, honoring, 60–61
 - See also* experiential learning; studio-based learning
- learning community, 141–142
- learning objectives, 139–140
- learning outcomes
- benefits of competencies/making, 136–138
 - maker competencies as, 26–27
 - maker competencies, in courses and, 130–133
 - maker competencies list, development of, 23–24
 - maker competencies mapped to, 147–148
- lesson plans
- of Albertsons Library MakerLab, 56
 - for 3D printing for teachers, 116
 - for Wranglers, 47
- librarians
- feedback from, 24
 - focus on creation with FabLab, 7–8
 - library makerspace, impact of, vii
 - on Maker Literacies Task Force, 21–22
 - maker-based competencies, 10–11
 - STEAM, adoption of, 19–20
 - for UTA FabLab, 11–12
- licensing, 32
- life-cycle phases, 91
- longitudinal research, 123

M

M5 makerspace, 114

Madsen, Leslie, 57–58

Madsen-Brooks, Leslie, 154

Make School initiative, 56

maker assignments

benefits of incorporating making into
courses, 136–138

course development by faculty, 138–142

curriculum design with maker

competencies, 148

incorporation of maker competencies into
courses with existing, 133–134

incorporation of maker competencies into
courses without existing, 130–133

maker competencies

benefits of incorporating into courses,
136–138

beta competencies in courses, discussion/
implications, 138–142

Beta List of Maker Competencies, 143–145

challenges of incorporating into courses,
134–136

competency 13, 54, 57–58

in courses with existing making
assignments, 133–134

definition of, 16

DeLaMare Library's IMLS Maker

Competencies grant project, 40–42

drafting for Maker Literacies program, vii

Engineering Project Management course,
assessment metrics, 100–107

example courses from Maker Literacies
pilot program, 26–31

faculty reactions to, 129–130

for librarians of FabLab, 7–8

list of, development of, 23–24

Maker Literacies program, conclusion
about, 33–34

Maker Literacies program requirements
and, 31–33

Maker Literacies Task Force's work on,
70–71

Makerspace Leadership and Outreach
course and, 122

staffing challenges of grant project at UNR,
43–44

UTA FabLab and, 10–12

in Wrangler training, 47

Maker Competencies and the Undergraduate
Curriculum planning grant

DeLaMare Library's IMLS Maker

Competencies grant project, 40–42

DeLaMare Science and Engineering Library
at UNR, 36

pilot program, xi

Maker Competencies (Revised December 2018),
147–155

Maker Immersion: Developing Curriculum

Design and Assessment Skills for Academic

Makerspace Course Integration (LG-17-19-
0126-19), xi

maker literacies, 17–18

Maker Literacies for Academic Libraries:

Integration into Curriculum (Musick Peery),
viii

Maker Literacies librarian, 69–70

Maker Literacies program

ambassador for studio arts education, 75–78
beginning of, 69

conclusion about, 33–34

contextualizing for academic libraries, 17–18
Digital Media Lab, curriculum integration,
118–122

Emerging Technologies (Art 4392) course,
73–75

Engineering Project Management (IE 4340)
course, 79–80

goals of, 15

History of the Book (HIST 4332) course,
82–83

ideation, creation, expansion of, vii–ix

IMLS grant for, 24–26

incorporation of maker competencies into
courses, 128–129

maker competencies list, development of,
23–24

Maker Competencies (Revised December
2018), 147–155

Maker Literacies Task Force, 21–22

Mathematics in the Middle Grades (EDML
4372) course, 80–81

pilot program, example courses from,
26–31

- Maker Literacies program (*cont'd*)
 - presentation about at TX STEM Librarians Conference, 18–21
 - QEP course development with, 128–129
 - requirements, 31–33
 - Spanish Culture and Civilization (SPAN 3311) course, 83–84
 - Technology in Art Education (Art 4365) course, 72–73
 - as transdisciplinary educational makerspace, 18–21
 - website of, ix, 148
- Maker Literacies Program Team
 - jargon in list of maker competencies, 148–149
 - program development by, 31–32
 - team members of, 22
- Maker Literacies Task Force (MLTF)
 - creation of, 70–71
 - Engineering Project Management course, collaboration for, 79–80
 - establishment of, 21–22
 - formation of, 70–71
 - IMLS grant for Maker Literacies program, 24–26
 - list of members, 154
 - maker competencies list, development of, 23–24
 - Mathematics in the Middle Grades course, 80–81
- maker principals, 122–125
- MakerBot 3D Printing Innovation Center, 113
- MakerLab at Boise State University
 - conclusion about, 63
 - culturally responsive/inclusive practices, 61–63
 - inclusion, design for, 53–54
 - maker-related pedagogy, 56–60
 - origins of, 55–56
 - prior learning, honoring, 60–61
- makers, 62
- makerspace director, 45
- Makerspace Leadership and Outreach (SPP 597M), 120–122
- makerspace manager, 43, 46
- makerspaces
 - ad hoc service, 35–36
 - ambassador for studio arts education, 75–78
 - culturally responsive/inclusive practices for, 61–63
 - culture of openness, creativity, connection, 125
 - of DeLaMare Science and Engineering Library at UNR, 35–50
 - in Engineering Project Management course, 108
 - FabLab, creation of, 3–4
 - FabLab, design strategies of, 4–7
 - FabLab, innovation in teaching/learning practice, 7–12
 - FabLab, present/future of, 12–13
 - inclusion by design, 53–54
 - in libraries for hands-on learning, 2–3
 - maker competencies list and, 23–24
 - Maker Literacies pilot programs, example courses from, 26–30
 - Maker Literacies program, vii–ix
 - Maker Literacies program requirements, 30–33
 - MakerLab at Boise State University, 53–63
 - prior learning, honoring, 60–61
 - prior service/training model, UNR Library makerspace, 37–40
 - space concerns, 44–45
 - UNR makerspace, new service model for, 45–50
 - See also* UTA FabLab
- making, 128–129
- Making + Learning project framework, 128
- Maloy, Robert, 116
- management, 151–152
- Math, Art, and the Human Experience (MATH 58), 131–132, 135–136
- mathematics
 - incorporation of maker competencies into course, 130–133, 135–136
 - Maker Literacies pilot program, 28, 29
- Mathematics in the Middle Grades (EDML 4372) course, 80–81
- Mathews, Brian, 3
- Mav Shirt (semester project)
 - description of, 92
 - final product, 98
 - final team logo design, 96
 - proposed team logo design, 94
- May, Cedrick, 28, 155

McCombs, Mark

as faculty beta tester, 155

“Faculty Collaborations to Put Maker
Competencies into Course Assignments,”
127–142

information about, 161

*Meaningful Making: Projects and Inspirations for
Fab Labs and Makerspaces* (Blikstein, Martinez,
& Pang), 56–57

milestones, 95

Miller, Nicole, 155

Mini Mav (semester project)

description of, 92

final podium design, 96

final product, 98–99

final stable design, 96

proposed podium design, 95

proposed stable concept, 94

requirements for, 92–93

Mizzy, Dorianne

“Faculty Collaborations to Put Maker

Competencies into Course Assignments,”
127–142

as IMLS grant partner site coordinator, 154

information about, 161

MLTF

See Maker Literacies Task Force

mobile showcase, 117

multimedia, 110–111, 113

Multiple Teaching Practices in Mathematics and
Science (Education 4333) course, 28

Musick Peery, Katie

on grant writing team, 25

Maker Literacies program, beginning of,
69

on Maker Literacies Task Force, 22, 154

preface, vii–ix

N

National Association of Colleges and Employers
(NACE) Job Outlook 2016, 23

National Science Foundation, 19

natural world, 110

needs assessment, 111–112

Noble, Paul, 155

noise, 37

O

Object-Oriented Software Engineering
(Computer Science and Engineering 3311)
course, 28

open platform, 120–121

open scholarship, 124

open-ended questions, 104–105, 106–107

openness, 125

origami fabrication assignment, 130, 133

outreach

by Digital Media Lab, 117

Makerspace Leadership and Outreach,
120–122

P

PBL (project-based learning), 29

PCB milling machine, 38

peer leadership

Digital Media Lab staffing with focus on,
112–113

peer-led workshops at DML, 111–112

Peltier, Rick, 120

PERT (Program Evaluation and Review
Technique) analysis, 97

Planet Earth Lab (GEOL 101L with Lab)

benefits of competencies/making in
courses, 138

beta maker competencies, learning
outcomes, rubric criteria, assignments,
131–132

challenges of incorporating competencies
into, 134, 135

making assignment for, 133–134

planning, 90

play, 5–6

Plenge, Megan, 127–142, 161

PM certificates, 88

PMI (Project Management Institute), 88

PMP (Project Management Professional), 88

Pole, Kathryn

on grant writing team, 25

on Maker Literacies Task Force, 22, 154

pre- and post-surveys, 102–107

prebooked consultations, 46

Principles and Methods of Teaching Biology
(BIOL 410)

benefits of competencies/making, 137

Principles and Methods of Teaching Biology (BIOL 410) (*cont'd*)

- beta maker competencies, learning outcomes, rubric criteria, assignments, 131–132
- challenges with incorporating competencies into course, 136
- making assignment for, 134

prior learning

- honoring, 60–61
- of students, use of, 59–60

problem-solving capabilities, 120, 123–125

professional development, 142

Program Evaluation and Review Technique (PERT) analysis, 97

project management course

- assessment metrics, 100–107
- conclusion about, 108
- Engineering Project Management course, overview of, 88–89
- project management, overview of, 89–90
- semester project, 91–99
- stage-gate process, 90–91
- theory, need for, 87–88

Project Management Institute (PMI), 88

project management (PM) tools, 88

Project Management Professional (PMP), 88

project manager

- change request form, submission of, 97
- responsibilities of, 90

project-based learning (PBL), 29

prototype stage, 91–92, 97

Q

quality, 90

Quality Enhancement Plan (QEP)

- development of, 128–129
- “Experiential Learning” theme, 21
- faculty learning community and, 141
- maker competencies consulting sessions with, 130
- making incorporated into, 128

questions, open-ended, 104–105, 106–107

R

Radniecki, Tara

- on grant writing team, 25

- on IMLS grant team, 154
- information about, 162
- “Transforming from an Ad Hoc Service to an Integrated Curricular Component,” 35–51

reflection

- for course development, 141
- in experiential learning, 8–9
- interview questions for end-of-semester faculty reflection, 140

resources

- Beta List of Maker Competencies, 143–145
- Maker Competencies (Revised December 2018), 147–155

risk-taking, 5–6

Roye, Jennifer, 22, 154

rubrics

- benefits of competencies/making in courses, 136–138
- competency-informed assessment rubrics for courses, 131–133
- interview questions for end-of-semester faculty reflection, 140
- making assignments for courses, 133–134

S

Schreyer, Alex

- Designing with 3D CAD and DIM (BCT 420), 119
- as faculty beta tester, 155
- Honors Discovery Seminar, Adventures in 3D Printing, 118–119

Schweik, Charlie, 120–122, 155

science, 75–76

sculpture course, 67–68

service desks, 49

service learning credit, 30

service model

- for makerspace, implementation of new, 45–50
- prior service/training model, UNR Library makerspace, 37–40

sharing, 152–153

shoes, 58

skills

- of project manager, 90
- studio arts skill-building/assessment, 67–68
- See also* maker competencies

- slack/float analysis, 97
- Smart, Kasey, 115
- SME
 - See* subject matter expert
- Smedley, Lauren, 2
- social issues, 61–63
- social responsibilities core value, 55
- software, 106, 115
- SOW (statement of work), 93, 95
- space
 - of makerspace, challenges of, 44–45
 - UNR makerspace, physical space changes, 48–49
- Spanish Culture and Civilization (SPAN 3311)
 - course, 83–84
- Sparks, David
 - as faculty beta tester, 155
 - on Maker Literacies Task Force, 22, 154
 - Multiple Teaching Practices in Mathematics and Science (Education 4333), 28
- staff
 - for DeLaMare Library's makerspace, 38, 43–44
 - for Digital Media Lab, 112–113, 114–115
 - feedback from, 24
 - student staffing of UNR makerspace, 45–47
 - for UTA FabLab, 6, 11–12, 69
- stage-gate process, 90–91
- stages
 - of Engineering Project management course, 91–92
 - in stage-gate process, 90–91
- statement of work (SOW), 93, 95
- STEAHM (Science, Technology, Engineering, Arts, Humanities, and Mathematics), 5
- STEAM (Science, Technology, Engineering, Art, and Mathematics)
 - Dominick Casadonte on adoption of, 18, 19–20
 - STEM education *vs.*, 76–78
- STEM (Science, Technology, Engineering, and Mathematics)
 - genesis of concept of, 19
 - prior learning and, 60
 - reintegration with STEAM, 20
 - STEAM education *vs.*, 76–78
- strategic planning document, 112
- student learning outcomes
 - See* learning outcomes
- Student Success and Engagement Department, 112, 117
- students
 - access to multimedia production labs, 111
 - ambassador for studio arts education, 75–78
 - as ambassadors for FabLab, 74–75
 - art, experimentation *vs.* finished projects, 65–66
 - assessment, Maker Literacies program's approach to, 78–79
 - benefits of competencies/making in courses, 136–138
 - digital fabrication homework methods/results, 103–107
 - Digital Media Lab, campus needs assessment, 111–112
 - Engineering Project Management course, assessment metrics, 100–107
 - Engineering Project Management course, semester project for, 91–99
 - example courses from Maker Literacies pilot program, 26–31
 - experiential learning and, 8–9
 - learning outcomes from Maker Literacies courses, 32
 - makerspace at UNR Library, use of, 35–36
 - makerspace design for, 4
 - peer-led workshops at DML, 111–112
 - prior learning, honoring, 60–61
 - self-assessment surveys by, 80
 - as staff for Digital Media Lab, 114–115
 - as staff for FabLab, 69
 - as staff for UNR makerspace, 45–47
 - studio arts skill-building/assessment, 67–68
 - UAE students, Makerspace Leadership and Outreach course for, 122–125
 - UTA FabLab design for, 5–6
 - Wranglers, training for, 38–39
- studio-based learning
 - ambassador for studio arts education, 75–78
 - conclusion about, 84–85

- studio-based learning (*cont'd*)
 - Emerging Technologies (Art 4392), 73–75
 - Engineering Project Management (IE 4340) course, 79–80
 - FabLab, expansion of, 69
 - History of the Book (HIST 4332) course, 82–83
 - Maker Literacies Task Force, 70–71
 - Mathematics in the Middle Grades (EDML 4372) course, 80–81
 - project success/student learning of new skills, 65–66
 - Spanish Culture and Civilization (SPAN 3311) course, 83–84
 - studio arts skill-building/assessment, 67–68
 - Technology in Art Education (Art 4365) course, 72–73
 - work beyond pilots, 78–79
- subject matter expert (SME)
 - at concept stage gate presentation, 94
 - in Engineering Project Management course, 89
 - at presentation of final products, 98
- subtractive fabrication, 106
- survey
 - for digital fabrication homework assignment, 103–107
 - dual-post survey, 79
 - for Engineering Project Management course, 100–107
 - FabLab pre-survey, 92
 - for Maker Literacies program, 33
 - for reflection about course development, 141
 - of sculpture students, 67–68
 - student self-assessment surveys, 80
- T**
- teachers
 - See* faculty
- teaching
 - innovation in teaching/learning practice with FabLab, 7–8
 - 3D printing for, 116
 - “Teaching and Learning through Making” (Trkay & Bichel), 1–13
 - teaching assistants (TAs), 134
 - teaching consultation, 47
- teams
 - “Assembles effective teams” competency, 100, 104, 135
 - “Assembling Effective Teams” homework assignment, 101–103
 - concept phase of Engineering Project Management course, 93–94
 - design phase of Engineering Project Management course, 95–96
 - design phase of Project Management course, 95–96
 - for Engineering Project Management course, 92
 - formation of for Engineering Project Management course, 93
 - geology course making assignment for, 133–134
 - prototype phase of Engineering Project Management course, 97
 - student creation of, 88–89
 - UNC-Chapel Hill’s team-based approach, 142
- Technical Communication (English 3373) course, 28, 30
- technical expertise, 6
- technology
 - of DeLaMare Library’s makerspace, 37–38
 - for Emerging Technologies (Art 4392) course, 73–75
 - of MakerLab at Boise State University, 55–56
 - See also* equipment
- Technology in Art Education (Art 4365) course, 28, 72–73
- testing, 24
- theory, 87–88
- 3D modeling
 - Designing with 3D CAD and DIM (BCT 420), 119
 - digital fabrication homework methods/results, 103–107
 - in History of the Book course, 82–83
 - in Mathematics in the Middle Grades course, 81
 - training for Wranglers, 39
- 3D printing
 - bust scans of female students from UAE, 124

- of DeLaMare Library's makerspace, 35–36, 37, 38
 - at Digital Media Lab, 113–115
 - Honors Discovery Seminar, Adventures in 3D Printing, 118–119
 - MakerBot 3D Printing Innovation Center at DML, 113
 - at MakerLab, 57, 62–63
 - mobile showcase of, 117
 - training for Wranglers, 39
 - “3D Printing 4 Teaching and Learning” (Trust & Maloy), 116
 - 3D scanners, 35, 38
 - time, management of, 90
 - tinker, 149
 - Tinkercad, 81
 - tour, of Digital Media Lab, 117
 - training
 - student design of training for FabLab, 40
 - user training, UNR makerspace, 47–48
 - of Wranglers, 38–39, 44
 - of Wranglers in new service model, 45, 46–47
 - transdisciplinary
 - academic libraries as, 21
 - Maker Literacies program as, 20
 - use of term, 19
 - transferability, 9
 - “Transforming from an Ad Hoc Service to an Integrated Curricular Component” (Radniecki), 35–51
 - Trkay, Gretchen
 - information about, 162
 - Maker Literacies program, beginning of, 69
 - on Maker Literacies Program Team, 22
 - on Maker Literacies Task Force, 154
 - “Teaching and Learning through Making,” 1–13
 - Trust, Torrey, 116
 - TX STEM Librarians Conference, 18
- U**
- UAE Innovation Ambassadors Program, 122–125
 - UAE Ministry of Education, 122, 124
 - United Arab Emirates (UAE), 122–125
 - University of Los Andes (Uniandes), Bogotá, Colombia, 121
 - University of Massachusetts Amherst (UMass Amherst)
 - curriculum integration with DML, 118–122
 - Digital Media Lab, 3D printing at, 113–115
 - Digital Media Lab as ecosystem, 109–110
 - Digital Media Lab, development of, 110–113
 - DML outreach strategies, 117
 - faculty beta testers at, 155
 - Maker Literacies program, viii
 - partnership with, 26
 - Summer Programs, 122
 - University of Nevada, Reno (UNR)
 - challenges for makerspace, 42–45
 - faculty beta testers at, 155
 - IMLS grant for Maker Literacies program, 25
 - IMLS Maker Competencies grant project, 40–42
 - Maker Literacies program, viii
 - makerspace, new service model, 45–50
 - makerspace, prior service/training model, 37–40
 - makerspace, student use of, 35–36
 - partnership with, 26
 - University of North Carolina at Chapel Hill (UNC-Chapel Hill)
 - assessment rubric, 131–132
 - benefits of competencies/incorporating making, 136–138
 - challenges of competencies/incorporating making, 134–136
 - faculty beta testers at, 155
 - faculty reactions to maker competencies, 129–130
 - incorporation of maker competencies into courses with existing making assignments, 133–134
 - incorporation of maker competencies into courses without existing making assignments, 130–133
 - maker competencies incorporation, discussion/implications of, 138–142
 - maker competencies, integration into courses at, 127
 - Maker Literacies program, viii
 - partnership with, 26
 - Quality Enhancement Plan/Maker Literacies project, 128–129

- University of Texas at Arlington (UTA) Libraries
 - Engineering Project Management course, design/implementation in, 87–108
 - FabLab, creation of, 3–4
 - FabLab, design strategies of, 4–7
 - FabLab, innovation in teaching/learning practice, 7–12
 - faculty beta testers at, 155
 - as hub for making, 1–2
 - maker competencies list, development of, 23–24
 - Maker Competencies (Revised December 2018), 147–155
 - maker literacies, contextualizing for academic libraries, 17–18
 - Maker Literacies pilot program, example courses from, 26–31
 - Maker Literacies program, vii–ix, 15–16
 - Maker Literacies program, conclusion about, 33–34
 - Maker Literacies program, for academic libraries, 17–18
 - Maker Literacies program, IMLS grant for, 24–26
 - Maker Literacies program requirements, 31–33
 - Maker Literacies program, presentation about, 18–21
 - Maker Literacies Task Force, 21–22
 - Maker Literacies Task Force, creation of, 70–71
 - MakerLab's work with, 56
 - Morgan Chivers' work at FabLab, 68
 - partnership with UMass Amherst, 118–122
 - UTA FabLab, present/future of, 12–13
 - unpracticed skills, 66
 - UNR
 - See* University of Nevada, Reno
 - user training, 47–48
 - UTA FabLab
 - ambassador for studio arts education, 75–78
 - creation of, 3–4
 - design strategies, 4–7
 - digital fabrication homework methods/ results, 103–107
 - digital fabrication, student assessment of, 101–102
 - Emerging Technologies (Art 4392) course, 73–75
 - for Engineering Project Management course, 79–80, 88–89, 91–99, 108
 - expansion of, 69
 - History of the Book (HIST 4332) course, 82–83
 - as hub for making, 1–2
 - innovation in teaching/learning practice, 7–12
 - maker competencies and, 27
 - maker literacies, contextualizing for academic libraries, 17–18
 - Maker Literacies pilot programs, example courses from, 28–31
 - Maker Literacies program, vii–ix
 - Maker Literacies Task Force, 70–71
 - Maker Literacies Task Force and, 21
 - makerspaces in libraries, 2–3
 - Mathematics in the Middle Grades (EDML 4372) course, 80–81
 - Morgan Chivers' work at, 68
 - present/future of, 12–13
 - Spanish Culture and Civilization (SPAN 3311) course, 83–84
 - students working in, 29
 - Technology in Art Education (Art 4365) course, 72–73
 - UTA Libraries
 - See* University of Texas at Arlington (UTA) Libraries
- V**
- values, 153
 - Vecchione, Amy
 - as IMLS grant partner site coordinator, 154
 - "Inclusion by Design," 53–63
 - information about, 162
 - version control, 149
 - volume calculation, 81
- W**
- W. E. B. Du Bois Learning Commons, 111
 - W. E. B. Du Bois Library
 - curriculum integration with DML, 118–122
 - Digital Media Lab, 3D printing at, 113–115
 - Digital Media Lab, development of, 110–113

- Digital Media Lab in, 109
- DML outreach strategies, 117
- Wallace, Martin K.
 - on grant writing team, 25
 - information about, 162
 - as Maker Literacies librarian, 11–12, 70
 - on Maker Literacies Program Team, 22
 - on Maker Literacies Task Force, 22, 154
 - “Who, What, and Why: Contextualizing Maker Literacies for Academic Libraries,” 15–34
 - work on Maker Literacies initiative, 79
- water sensor, 121
- website, 30, 148
- “Who, What, and Why: Contextualizing Maker Literacies for Academic Libraries” (Wallace), 15–34
- Williams, Joe M., 127–142, 162
- work breakdown schedule (WBS), 95
- workshops, 74–75, 111–112
- Worlow, Christian, 155
- Wranglers (expert student employees)
 - assistance from, 41, 42
 - for DeLaMare Library’s makerspace, 38
 - physical space of makerspace and, 49
 - staffing challenges, 43
 - student staffing in new service model, 45–47
 - training of, 40
- Writing, Rhetoric, and Multimedia Authoring (English 3374) course, 28