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"If You Build It Will They Come?: Building a FabLab in the University of Texas @ Arlington Libraries and Building Faculty Partnerships for Its Use"

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If You Build It, Will They Come?: Building a FabLab in the University of Texas at Arlington Libraries

If You Build It Will They Come?

With the rapid rate at which technology is impacting the field of librarianship, it has become critical for libraries to become more innovative in all areas of their operations: from the way physical spaces are being envisioned or re-envisioned, to the types of services being offered, and even to the new roles that librarians are now assuming. All types of libraries are being affected, and the University of Texas at Arlington (UTA) Libraries are not immune. The purpose of this paper is to describe why the UTA Libraries chose to build a "FabLab" (short for fabrication laboratory) and not a "makerspace," and some of the activities that were undertaken to make the beta version of the lab a reality. It highlights the efforts that were made to reach out to faculty, specifically faculty in the College of Engineering, to encourage them to integrate various hands-on learning activities in their courses, and get them to use the FabLab as a space to apply and reinforce classroom learning. The paper also discusses the long-term vision for the lab.

Introduction

As the University of Texas at Arlington was positioning to achieve Tier One status (recognition as a world-class research university), the arrival of a new Dean of Libraries in 2012 signaled the beginning of a new era. Shortly after her arrival, there was talk of library-wide reorganization. The reorganization process was, in some ways, a move to transform the Libraries from the staid, mediocre libraries they were, into "next generation" Libraries, capable and equipped to better serve this new generation of students. During all the discussions and other activities that accompanied this reorganization process, the Libraries' administration made a strategic commitment that the Libraries would change course, and that instead of doing things the traditional way, the Libraries would now be much more forward-thinking, and provide transformational learning experiences through **C**reation, e**X**ploration, and **I**nnovation (CXI – which became the Libraries "hedgehog" concept). According to Jim Collins' book *Good to Great*, an organization's "hedgehog" is, simply put, that service or idea that an organization chooses that they can be truly passionate about, and that they can become great at.[1] As a result of this decision, the Libraries' leadership identified certain goals which were to be the framework through which the Libraries were supposed to achieve their hedgehog. One of these goals, a marker in this milestone reorganization process, was to build a FabLab in the Central Library.

Literature review

Several articles discuss the growing trend for libraries to develop and incorporate makerspaces as part of their regular operation. Most of these articles have been written as blog posts, on various websites, as "open articles," or as opinions. In his editorial, Colegrove describes makerspaces as spaces that encompass a "continuum of activity," and goes on to state the difference between the terms "co-working," "hackerspace," and "fablab," terms which are sometimes used interchangeably. He determines that despite the subtle differences in meaning, there is a commonality between all – that the said space is dedicated to patrons engaged in some sort of

"making."[2] A number of authors have written about the value of such spaces in libraries, particularly in public libraries.[3] Abram gives a broad overview of makerspaces in libraries. He addresses the educational role of such spaces, particularly in public and school libraries, and justifies why having a makerspace in the library is beneficial to all, because it aligns perfectly with the "library's role in neighborhood and educational settings."[4] Balas also posits that makerspaces add value to libraries, considering the evolving state of libraries, which has been triggered by the increasing use of technology. She quotes Torrone, writing for the *Make* magazine blog in 2011, as stating that libraries have historically provided their patrons with the "tools of knowledge," and since those tools (referring to books and other reading materials) are now so easily accessible, libraries need to transform to provide access to other tools that are now not that readily available.[5]

Even though much has been written about such spaces in public, and even school libraries, there seems to be a dearth of literature when this relates to academic libraries. Regardless of the fact that there are variations of makerspaces in academic institutions such as MIT and Georgia Tech, some academic librarians have not embraced having such a space in their libraries. The mostly-negative comments that follow Smale's blog post are indicative of how opposed some academic librarians are toward such an idea.[6] There is, however, a growing number of forward-thinking academic libraries that have developed these spaces, such as the University of Michigan, University of Maryland, and University of Nevada, Reno – DeLaMare Science & Engineering Library. An article by Erin Fisher in the ACRL TechConnect Blog, highlights the value of makerspaces in an academic setting – the provision of opportunities for students to learn with their hands, and the value of play in critical thinking. She also suggests that since academic libraries desire to be the intellectual hub on campus, they should be able to expand their reach by "providing materials, spaces and support for collaborative making" - in this case, providing "space that acts as an incubator of ideas, and provide the tools for rapid prototyping of such ideas."[7] Samantha Rich surveyed makerspaces in academic libraries to "determine how makerspaces complement the missions of their host libraries…" and discovered "that democratization of technology, the maintenance of the library's perception as a leader in technology innovation, and the need to support scholarship" were the most cited reasons for academic libraries to have makerspaces.[8]

What is a FabLab?

Bjorner describes the FabLab as "a part of the larger makerspace movement, which is inventing a future in which anyone can make anything." She describes digitized fabrication as a process that goes beyond what ordinary makerspaces can do. She states that they go "even further, in some cases, to where machines can make other machines, allowing people to 'turn data into things and things into data.'" According to her article, the first FabLab was started at MIT when Professor Gershenfeld, the Director of MIT's Center for Bits & Atoms (CBA) was asked to provide evidence of social impact for the funding he had received from the National Science Foundation for research into digital fabrication. It is the extension arm of the CBA that is responsible for educational outreach. Even though the originator of the FabLab concept had not envisioned any connection between digital fabrication and education, this connection has definitely now been integrated into its function.[9]

Among other things, FabLabs are a knowledge-sharing global network of labs that enable invention by providing access to tools for fabrication. They are a "distributed laboratory for research and invention" that offer their members a place to "play, create, learn, mentor, and invent." There are distinct differences between makerspaces and FabLabs. FabLabs have certain standards to which they must adhere, and a set of basic equipment to which they should provide access. In addition, FabLabs focus on outreach to the community, digital fabrication, and the provision of access to other FabLabs.[10] Conversely, however, makerspaces are completely independent, mostly community-based, and run by their members.[11] FabLab users are obligated to not only learn themselves, but also to mentor others, whereas members of makerspaces are not.

The inception and plans

The idea to build a FabLab was to strengthen the Libraries' hedgehog of CXI. A regular makerspace, as was clearly becoming a trend in libraries, was not considered strong enough to capture the vision in the Libraries' strategic plan. The lab was envisioned as a space with relevant, current technologies, to ignite creativity in anyone who was a part of the UTA community. Additionally, the opportunity to be one of the MIT-affiliated FabLabs, was seen as not only good for enhancing students' experience, but also as a great marketing tool for the university. In short, the Libraries administration decided to build a FabLab because FabLabs have the technology and the educational focus that makerspaces do not.

Although such labs are generally associated with Engineering, the Libraries' leadership decided that the vision would be expanded beyond the normal STEM (Science, Technology, Engineering, Mathematics) affiliation, to include the arts, thus changing the emphasis to embrace STEAM (Science, Technology, Engineering, Arts, Mathematics). This was an ambitious plan for a number of reasons: the Libraries' leadership wanted to build the first FabLab in Texas (this unfortunately did not happen because Fab Lab El Paso was the first one to be built), the first in the University of Texas System, and the first in a university library in Texas that was open to all. After several meetings between staff of the Libraries and that of the university facilities offices, a space was identified on the first floor of the Central Library (the main library), to serve as the lab's location. About a year earlier, the Libraries had already invested in a number of 3D printers which were already being heavily used, and so these were designated to serve as the main features in the space.

In the period leading up to, and during the construction of the FabLab in 2014, senior administration embarked on several site visits to other similar labs, including the FabLab in Tulsa, OK, seen as the most complete free-standing community-based lab, unaffiliated with any university; the Champaign-Urbana Community Fab Lab, which had a strong outreach to the community through its programming; and Washington University in St Louis, whose digital fabrication labs, eventhough not identified as part of the FabLab network, were providing services for faculty and students that the administration hoped to emulate. Such trips were undertaken as part of a familiarization process, to enhance the team's knowledge about the operation and management of such labs in both university and community-based settings.

As one of the cornerstones of the Libraries' hedgehog, several of the 49 initiatives stemming from the Libraries' strategic plan were dedicated to making the building and operationalization of this lab a reality, and several task forces were formed for this purpose. One of these task forces was charged with designing the space, and deciding on the specifications of the equipment for this beta lab. Another was charged with developing the plan for building partnerships with faculty to create components of their courses that would be FabLab-based.

While preliminary discussions surrounding the building of the FabLab were ongoing, a different task force carried out an environmental scan to identify other makerspace-like facilities on campus, types of equipment being used, and courses with maker-type assignments and activities. The results revealed that there were already several 3D printers in various departments on campus, most of which were in the College of Engineering, and one in the School of Architecture.

In her role as liaison to the College of Engineering, the Engineering Librarian embarked on an exploratory venture to find out the number and level of usage of the 3D printers in the College of Engineering. She also wanted to better gauge the reaction of the faculty to the Libraries having a FabLab on campus. In the course of this pursuit, it was discovered that the Department of Mechanical Engineering had the highest demand for and usage of 3D printers. She also discovered that because the printers being used were the more expensive type, the work done on those departmental printers was mostly mediated – i.e., it was supervised by the professors in whose labs the printers were located or by graduate students who had been carefully selected and trained by the professors themselves. During this outreach exercise to the Engineering faculty, several of the professors raised concerns about various aspects of the Libraries' initiatives regarding the FabLab. Some of these concerns centered on issues of safety, liability, cost, maintenance, and the general operations of the lab.

All the information gathered during this exploratory phase by the Engineering Librarian and others underscored the fact that the reasons why the Libraries were undertaking such a venture were indeed very solid. The availability of 3D printers on campus was not going to be a conflict, nor an obstacle to the Libraries' plan to procure additional 3D printers and build a FabLab. What became more evident, was that access to the existing 3D printers was limited to students in specific departments or schools, so the Libraries' plan would be a welcome alternative, since it would democratize access. Contrary to what was provided in the College of Engineering or the School of Architecture, the Libraries were planning to develop a space that would provide 24-hr access to students and faculty, irrespective of discipline, and to the community. The space would be a creative hub for project-based, hands-on learning for everyone.

The Dean of Libraries, in Deans Council and other meetings with her colleagues, shared the Libraries' plans and endeavored to gain support from them. Unsurprisingly, there was some initial skepticism because not everyone fully understood why the Libraries were undertaking such a project. Nevertheless, with persistent determination, and several face-to-face meetings, the leadership was able to convince most people of the utility and relevance of the project. As planning ensued, faculty members who were considered as having requisite expertise, including some from the College of Engineering, were invited to meetings regarding directions of the FabLab.

The vision for the use of the lab extended beyond UTA, to include the surrounding local community. There were other stakeholders who were interested in the success of the project - the local county maker group, local businesses, and the alumni association. These all provided invaluable feedback that helped shape the development of the lab. There were plans to use the expertise and knowledge from not only the faculty, but also that of the local maker group to develop services to mentor users and teach workshops that would be open to all.

Current space and usage

Currently, the pilot lab is occupying just 700 sq. ft. on the first floor of the main library, but the ultimate plan is for it to take up 8,700 sq. ft. of space. As a beta lab, it has not yet been fully equipped with all that is required in a FabLab – only the technologies that are required as a start-up. [12] The lab officially opened on Wednesday, October 8, 2014, equipped with nine 3D printers, a laser cutter, vinyl cutter, three 3D scanners, digital media software and hardware, and other assorted tools and machines. Prior to this opening, the Engineering Librarian and other library liaisons were tasked to market the service to their constituents, and identify potential faculty willing to partner with the Libraries and use the lab as a place to reinforce classroom learning. Students were even encouraged to come in and work on projects that were extra-curricular.

While the assumption was that interest in the FabLab would be highest for students in Civil and Mechanical Engineering, it has surpassed expectations. (See Figure 1.). According to conversations with staff of the lab, there has been a variety of people coming in and working on projects, either in groups or individually. The Aero Mavericks, a student group that participates in rocket design competition has been using the 3D printers to build molds for their rockets and using the laser cutter to cut out wing slats for their drones. Professors and students from Architecture have used the equipment in the lab to design and cut out styrofoam patterns for their various projects. A Topology professor has also used the laser cutter to cut out shapes of houses that had been made out of metal. Students in Anthropology have used the 3D scanner and printer to make molds of fossils. In Archaeology, the 3D scanner has been used to scan the insides of artefacts that are normally too fragile to handle. The staff also report that the laser cutter has been the most popular equipment in the lab. The faculty in Bioengineering are eager to get their students to print out tissue scaffolds, valves, and other structures they're studying in their classes. The coordinators of the general Freshman Engineering course would like to bring their students in to work on various projects. The lab has seen, and is continuing to see, people from outside of the UTA community coming in to work on their various creations. A robotics group based in the community recently enquired about the possibility of using the FabLab equipment for designing tools for their projects. The lab has also had enquiries from local businesses about the possibility of providing consultation and training for local businesses interested in using the available technology.

FABLAB Number of Customers by Day and Shift								
Shift	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Shift Total
8:00 AM to 12:00 AM	3	10	4	7	2	1	1	28
12:00 AM to 4:00 PM	16	9	9	6	9	5	0	54
4:00 PM to 8:00 PM	12	11	15	13	11	12	6	80
8:00 PM to 12:00 PM	15	6	6	8	9	16	7	67
Day Totals	46	36	80	34	31	34	14	229

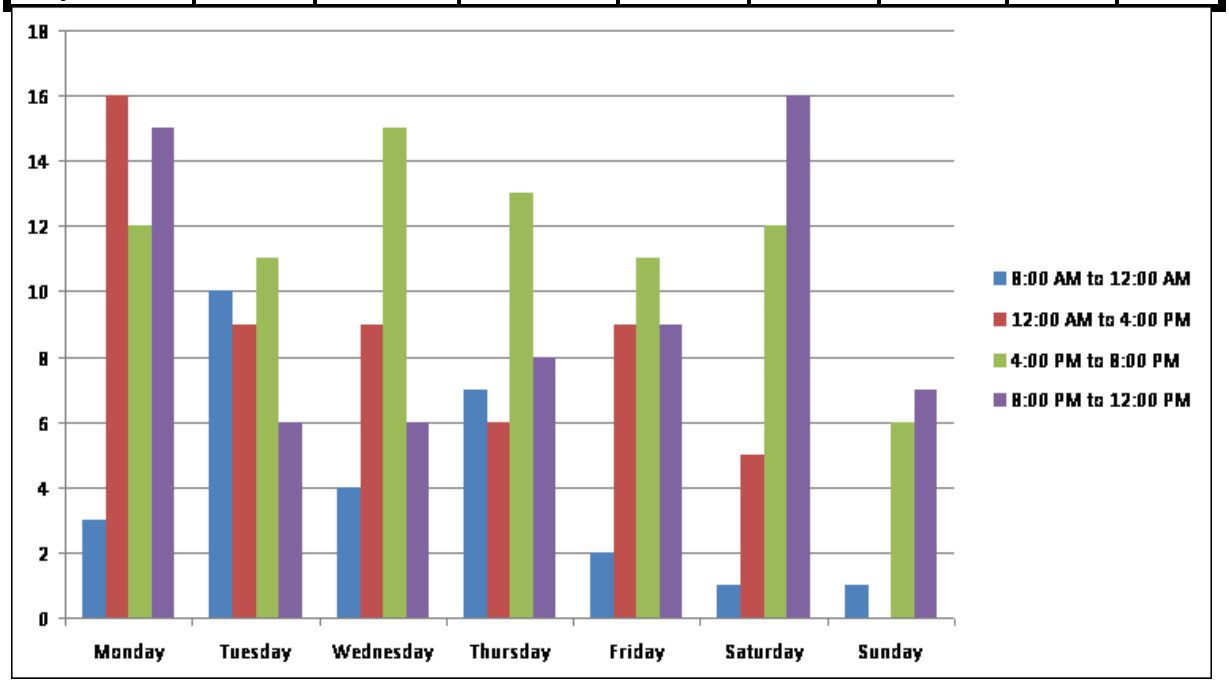

Figure 1. Typical week statistics – week ending 7 Dec. 2014

Current constraints and future plans

The current size of the space and the overwhelming positive response have posed some constraints. Faculty interested in bringing their classes for hands-on learning are being discouraged for now, because of the current lack of space. Further outreach to faculty has either slowed down, or been put on hold, until the future expansion is completed in the summer of 2015. A robust system of tracking usage of the lab in a consistent manner is being developed by the staff.

One solution that has been discussed to potentially satisfy present demands, and partially alleviate the space problem, is to develop a mobile FabLab unit that could be taken to classrooms on campus, or even moved off site. In spite of this, tours continue to be organized for various constituents both from off and on campus, and plans are being put in place for outreach to area K-12 schools to encourage students to come in, once the expansion is completed. In due course, more tools to complement the full suite of expected technologies in a FabLab, together with relevant equipment for an AV recording and practice studio, collaboration studios, and telepresence robots, will be added.[13]

Staffing

A technician has just been hired to temporarily manage the lab until a full-time director is in place; until recently, it was being managed by 2 Libraries employees who worked in the Library Systems & Technology department, but were apportioning a few hours of their time to the FabLab. It is also staffed by students from various disciplines on campus.

Costs

The project is presently funded by $200,000 from the Libraries' resources, and $10,000 from a grant from the Texas State Library & Archives Commission, with the expectation that a business plan that has been developed will be instrumental in finding future donor support.

As a measure of cost recovery, a fee structure has been developed for community users, with differential levels of payment for monthly and annual fees. Although the facility is freely accessible to all UTA students and faculty, everyone is charged for the use of consumables, but not for the use of the equipment.

Conclusion

So far, the adage of "if you build it they will come" has definitely been proven true in the case of our FabLab. Early success has shown that there is potential for the Libraries and colleges, including the College of Engineering, to develop a partnership where the Libraries will provide opportunities for students to gain relevant leadership experience in mentoring others in lab technology or 3D design. The new ongoing relationships with local businesses could also enhance opportunities such as internships and careers for graduates, which in turn could provide examples of student success that could be used in recruiting or fundraising by academic units, as well as the university.

It is noteworthy to state that other libraries can achieve similar success if they are willing to embrace this new service, particularly in light of the changing nature of libraries. Developing strategic partnerships and active marketing are key in making such an undertaking worthwhile. To paraphrase David Lankes, we should envision a bright future for our profession, and then act to make that vision a reality; failure to do so will mean obsolescence for our profession.[14]

References

[1] Collins, Jim. *Good to Great: Why Some Companies Make the Leap and Others Don't*. 1st ed. New York, NY: HarperBusiness, 2001.

[2] Colgrove, Tod. "Editorial Board Thoughts: Libraries as Makerspace?" *Information Technology & Libraries* 32, no.1 (2013): 2-5.

[3] Abram, Stephen and Jane Dysart. "The Maker Movement and the Library Movement: Understanding the Makerspaces Opportunity." *Feliciter* 60, no. 1 (2014): 11-13; Balas, Janet L. "Do Makerspaces Add Value to Libraries?" *Computers in Libraries* 32, no. 9 (2012): 33; Belbin, Nicole and Pat Newcombe. "Fab Labs at the Library: Community 'Makerspaces' Give Access to Cutting-edge Tools." *Education Digest* 78, no. 7 (2013): 65.

[4] Abram, Stephen. "Makerspaces in Libraries, Education, and Beyond." *Internet@Schools* 20, no. 2 (2013): 18-20.

[5] Balas. "Do Makerspaces Add Value." 33.

[6] Smale, Maura. "Making Things in Academic Libraries." *ACRLog (blog)*, October 16, 2012. http://acrlog.org/2012/10/16/making-things-in-academic-libraries/.

[7] Fisher, Erin. "Makerspaces Move into Academic Libraries." *ACRL TechConnect Blog*, November 28, 2012. http://acrl.ala.org/techconnect/?p=2340.

[8] Rich, Samantha N. "A Survey of Makerspaces in Academic Libraries." Master's paper for the M.S. in L.S degree, UNC Chapel Hill, 2014.

[9] Bjorner, Susanne. "Makerspaces and Fab Labs: Exploring the Physical and the Digital." *Online Searcher* 37, no. 5 (2013): 38-43.

[10] Gui, Cavalcanti. "Is it a Hackerspace, Makerspace, Techshop, or FabLab?" *Makezine*, May 22, 2013. http://makezine.com/2013/05/22/the-difference-between-hackerspaces-makerspaces-techshops-and-fablabs/; Neil Gershenfeld. "White Paper on FabLabs." *Principal Voices*, 2007. http://www.principalvoices.com/2007/technology.innovation/white.papers/neil.gershenfeld.html.

[11] University of Limerick. "The DYI Culture; Hackerspaces, Makerspaces, FabLabs and Personal Fabrication." *CSISWiki*, Nov. 2013. http://wiki.csisdmz.ul.ie/wiki/The_DYI_culture;_Hackerspaces,_Makerspaces,_FabLabs_and_Personal_Fabrication.

[12] Fab Foundation. "The Hardware and Software." http://www.fabfoundation.org/fab-labs/setting-up-a-fab-lab/setting-up-a-fab-lab/.

[13] Lewis, Bridget. "The [name of institution] Prepares for Oct. 8 Unveiling of New, State-of-the-Art Fab Lab." *University of Texas at Arlington News Release*, 7 Oct. 2014.

[14] Lankes, David. "Killing Librarianship." Keynote New England Library Association Annual Conference, 2011. http://quartz.syr.edu/rdlankes/Presentations/2011/NELA.pdf.