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Libraries, Makerspaces, and Constructionist Learning: The Maker Lab at Abilene Christian University

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What would Jesus Hack? Libraries, Makerspaces, and Constructionist Learning: The Maker Lab at Abilene Christian University

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The Abilene Christian University (ACU) Maker Lab opened in October 2013 as a 7,500-square-foot design studio and prototyping shop, where ideas could be developed in creative community with the expectation of rapid fabrication in order to test ideas and advance them to fuller production. In this presentation we will explain: 1) the history of the Maker Lab at ACU, 2) the pedagogical theory underlying the Maker Lab, 3) the rationale for a makerspace in the academic library, and 4) the results of a survey on the impact of the Maker Lab on faculty and student learning and engagement at Abilene Christian University.

I. MAKING THE MAKER LAB

The idea of a makerspace in the ACU Library arose in December 2012 during consideration of the importance of the “Maker Movement,” which is a global sub-culture focused on “do-it-yourself” (DIY) design and rapid fabrication of innovative products that address personal interests and sometimes broader societal problems. At the time, there were few, if any (we could not locate another), makerspaces in the main library on a university campus. There were three catalysts for pursuing the idea: 1) a drive among librarians and educational technologists to enhance teaching and learning experiences for a large number of faculty and students in the library, especially in service to the broader community; 2) growing demand on campus for educational spaces, tools, and other resources that especially support disciplines in Engineering and Technology; and, 3) the relocation of Special Collections and Archives into another, more environmentally secure location in the library, freeing up the space it formerly occupied.

Early in the process of developing the Maker Lab, we adopted an approach to creativity known as “design thinking.” This approach is variously defined, but has at its core a reiterative process of ideation, prototyping, testing, and refinement of a solution to a problem that is realized and improved through rapid fabrication of tangible objects. We adopted this approach to researching and building the Maker Lab, attempting to see or “feel” the problem and its context, partly by experiencing the problem in order to see and conceive it, and partly by quickly creating a possible solution.

Our unique approach to understanding the Maker Movement and makerspaces was the creation of a digital film in order to research and report on the origins and growth of these “maker” phenomena in New York City. A team of three videographers from the AT&T Learning Studio in the ACU Library traveled to NYC, interviewing leaders in the movement, and documenting the problems and solutions that the Maker Movement addresses. Interviews included Dale Dougherty, the founder of Maker

Magazine, as well as leaders from The NYU School of Arts, NYC Resistor, Makerbot, Supermechanical, The NY Hall of Science, and Etsy. This film, *We Are Makers* (blogs.acu.edu/wearemakers), was premiered to ACU leaders from across campus in June 2013, after two months of shooting, scoring, and editing. The film was integral to creating broader awareness of the issues addressed by the Maker Movement, as well as buy in (both figuratively and literally) for creation of a makerspace in the ACU Library.

Not only in its conception but also in its construction, the Maker Lab at ACU was developed according to the tenets of design thinking, especially the principle that one invents to learn, and that one learns as much from mistakes and failures as one does from success. Making in order to fail, we rapidly prototyped the Maker Lab with a view to gaining insights after its initial construction. This meant that we built for change, constructing as best we could at small scale and modest price. The result was a space with resurfaced concrete floor with minimal movement of walls, and maximal use of flexible furnishings. We added various tools, both low tech and high tech, from sewing machines and soldering guns to 3-D printers, laser cutters, and a CNC router.

Going into this venture and learning from other makerspaces, such as the Dallas Makerspace, we knew that empowerment of the university's student community would be key to the success of the Maker Lab. From the start we fostered an egalitarian approach to the design, operation, and ongoing improvement of the Lab. The creation of a Maker Lab Advisory Board, including staff, faculty, and students from across campus, was key to involvement and empowerment of the community. The advisory board identified needed improvements on an ongoing basis, providing guidance on everything from equipment needs to safety concerns to space organization. For example, the layout of the entire lab was essentially flipped after six months of operation due to valuable input from students on the advisory board. At one level, our initial design of the lab had failed; at another level, we had designed the lab with a scale and flexibility so that it could successfully fail and be improved. The drive and ability to adjust our space and our products to new experiences and insights is an enduring value and practice in the ACU Maker Lab.

II. PEDAGOGY OF CONSTRUCTIONISM

Constructionism (not be confused with “constructivism”) is the theory of teaching and learning that most informs activities in the Maker Lab. This pedagogical method is commonly used in the fine arts through artistic form, musical composition, and creative writing. The idea of “constructionist learning” states that optimal learning occurs during the creation process when the students produce tangible objects.

In *The Computer Clubhouse: Constructionism and Creativity in Youth Communities*, the theory of constructionism is described in relation to two types of construction:

First, [constructionism] asserts that learning is an active process, in which people actively construct knowledge from their experience in the world. People don't get ideas; they make them. This aspect of construction comes from the constructivist theory of knowledge development by Jean Piaget. To Piaget's concept, [Seymour] Papert added another type of construction, arguing that

people construct new knowledge with particular effectiveness when they are engaged in constructing personally meaningful products.¹

In this way, the constructionist learning process first begins as an internal mental process with the initial creation of ideas and the facilitation of that understanding. Then, through the construction process, students not only construct tangible objects, such as a poem, but they also internally construct further meaning and significance. This act of construction adds a higher level of learning through additional engagement and retention.

The Maker Lab's use of constructionist learning has led to the furthering of educational engagement and opportunities at ACU. As we will show below, students and faculty are finding new confidence in themselves and in their learning ability. They are finding out that they are no longer programmed to think only within their area of interest or expertise, but are broadening their thought processes in a multidisciplinary fashion.

Jonan Donaldson, an instructional designer and education professor at Oregon State University, has a personal appreciation for constructionist pedagogy. He has been working for years on furthering the educational system. One aspect of his new class structure has been to instill a stronger sense of responsibility and respect for learning and retention within his students. Donaldson has found that the constructionist approach gives students, no matter their age, the opportunity to create their own understandings, with greater appreciation of what they are learning. As Donaldson states in *The Maker Movement and the Rebirth of Constructionism*,

Over the last decade ... my teaching has undergone a dramatic transformation as... I played with many methods for getting... my students to learn not only through doing, but also through creating.²

Donaldson was unaware of the applications of constructionism until recently, but now reports that he has increasing appreciation for the opportunities provided within constructionist pedagogy:

New digital tools available to students have flung open the doors to creativity, imagination, and student-directed learning. The sheer number of possibilities is daunting for any educator. Educational theory can help guide our choices and guidance of student learning. Constructionism has inspired me like no other idea in education has ever inspired me.³

Donaldson describes an inspired creativity that we aim to foster in the Maker Lab through supporting and equipping a creativity community with a variety of technological tools and opportunities for making ideas tangible in the classroom and in the "real world."

III. RATIONALE FOR A LIBRARY MAKERSPACE

Libraries are not only book repositories, but are places where information is shared and knowledge is communicated. In addition, libraries have always encouraged learning through doing. When a student writes a research paper, they examine published

scholarly work, interpret the data, and synthesize it through writing. That is learning through doing. It is not much of a leap to move from 1) the act of creation through writing a paper or book, to 2) the act of creation through design or prototyping other physical objects, especially objects created through mastery of learned skills, and application of collected data.

Libraries have always had information in a variety of formats: books, periodicals, maps, audio visuals, digital materials. Makerspaces offer users access to information of a different kind, information that is experiential rather than codified. While many makerspaces do offer instructional resources in print or digital format, they also offer their users as accessible resources. The information-sharing environment that is endemic to makerspaces is perfectly suited to a library. More importantly, it is perfectly suited to librarians.

Makerspaces are about information sharing, but often that information is not a fact, it is a process. These processes still need to be documented and searchable. Librarians are trained in organizing and accessing information. Whether that information is housed in a book or in a skilled maker should make no difference. The majority of reference services in a makerspace are actually referrals. Referrals are something that every librarian should be familiar with. Referrals happen all the time at research desks. Librarians often connect patrons with subject specialists for in depth research projects. In maker spaces the referrals work the same way, connecting people with the information or person that they need. The only difference is that rather than a faculty member or librarian, a user may be referred to a student or staff person.

Makerspaces also have inherent concerns that librarians are trained to address. There is a need or desire to document the files and processes that makers utilize in their activities that can be in direct conflict with a maker's intellectual property rights. Librarians, who are trained in copyright and creative work licensing issues, can help navigate what portions of the processes can be saved and shared, and when only the prototype rather than the process needs to be documented. Once processes and products are documented, librarians are able to utilize existing library infrastructures or design new information systems to make those processes and products searchable and sharable.

IV. IMPACT ON ACU COMMUNITY

According to the constructionist approach of the Maker Lab, learning should be an ongoing conversation among collaborators with different levels of skills, but who are willing to share whatever they have and know. Relationships are built upon the collaborative efforts between students and faculty, or even faculty from different areas of concentration. A higher level of learning is achieved in this setting with all that is brought to the table. For example, students from the departments of Engineering, Physics, and Art/Design student came together last semester to design and prototype an ergonomic rocking chaise lounge with the use of the laser cutter, CNC router, and woodworking equipment. These three students were able to bring expertise from different fields, and to create a collaborative project that increased both the quality of

the final product, as well as their mastery of competencies in interpersonal collaboration and communication.

In this way, makerspaces rely on the expertise of the community members for teaching and learning. This results in a flattening of the typical academic hierarchy. Faculty and staff, who are generally in a teaching position, will find themselves being taught by their own students. This collaboration and community will impact not only the knowledge of the faculty or staff member, but it also holds the promise of enriching faculty pedagogy. Many assignments that involve an ACU Maker Lab component have shifted from a product-based grade to a process-based or competency-based assessment.

Students often report that they gain confidence as a result of learning and designing solutions to problems in the Maker Lab. Because the construction is iterative, collaborative, and often self-directed, students are empowered through previous efforts and the support of others to encounter new ideas, tasks, tools, and peers. This is the promise of “higher education” in the Maker Lab at ACU.

V. SURVEY RESULTS

In the spring of 2014 we conducted a survey of the maker lab at Abilene Christian University. We requested the involvement of our 222 registered makers. Of these, 56 students, faculty, and staff participated.

Among student respondents, the most common majors were (in order): Art and Design, Business, Engineering, and Digital Entertainment Technology. The survey asked what roles each maker had played as part of the maker lab community. Students say that they were taught new techniques by faculty/staff (77%), or by makers-on-duty (75%), while faculty/staff reported that they were most often (85%) taught new techniques by the “makers-on-duty.” One-half of our makers-on-duty are students, so that the student workers with appropriate skills regularly teach the faculty and staff of our campus how to design and make things. The survey also reported that one-half of the projects in the Maker Lab are collaborative efforts. When asked about the ways that the Maker Lab community impacted at ACU, one respondent replied in this way:

Being around people who enjoy working on the same things I enjoy working on gives me more motivation to continue working on my project when things get complicated. I enjoy working with like-minded people, rather than being on my own most of the time.

Nearly all of the respondents reported that the constructionist approach of the Maker Lab benefitted their academic pursuits and helped further their education. In light of this, it is noteworthy see that only 37.5% of the respondents reported that constructionist learning is used within their field of study on campus.

When asked what advantages the Maker Lab presented to their learning at ACU, two student responses are indicative of most of the others:

The use of the Maker lab and the experience I gain from using it helps me appreciate my major even more. It gives me the opportunity to improve my projects and turn them into something amazing.

[The Maker Lab] has shown me that so much more is now possible.

The survey results showed that the Maker Lab is appreciated and used jointly by many different majors across ACU, at both the undergraduate and graduate level. In this respect, The Maker Lab has already helped ACU to overcome barriers to collaboration and creativity. As we look to the future, we are finding new areas for growth and exploration with partners that we had not envisioned at the start, and this is leading us to break through barriers that have existed between the university and the broader community. But that is a story for another presentation.

ENDNOTES

- ¹ Yasmin B. Kafai, *The Computer Clubhouse: Constructionism and Creativity in Youth Communities* (New York: Teachers College Press, 2009), 19.
- ² “The Maker Movement and the Rebirth of Constructionism,” *Hybrid Pedagogy*, accessed September 16, 2014, <http://www.hybridpedagogy.com/journal/constructionism-reborn/>.

SUGGESTED READING

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