Peer-Reviewed Article

A U.S. History Makerspace

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Abstract: Makerspaces, creative learning environments that provide tools, resources and mentors for their members, have sprung up across the country. Maker culture can be found in higher education settings, as well. Online digital media labs, media creation tutorials, photo and media collections and editing tools, and software lending libraries are popping up from public providers across the country. In an online setting, a Makerspace would have to be comprised of virtual tools. I envision a Makerspace that works like a wiki, with all the tools I imagined for the three different types of projects in one place. Students would be able to choose which of the three types of projects they wanted to complete, or they could opt to do a mashup of two or more of the different types. Educational theories in the areas of Constructivism, cognitive tools and socio-cultural learning support the Makerspace approach. Although Makerspaces have grown quickly in the areas of science and engineering, it is hard to identify an area of academic inquiry that could not benefit from this approach. My hope is that I can take this approach and create interest and engagement in an online clubhouse devoted to History.

Keywords: makerspaces, virtual spaces, creative learning, U.S. History

The United States leads the world in educating its citizens in the areas of science and technology (Galama & Hosek, 2008). There are many initiatives underway to support the goal of maintaining and increasing the focus on STEM (science, technology, engineering and mathematics) in formal education (Roberts, 2013; Fioriello, 2010). One effort, the Maker Movement, supports STEM learning both within and outside the confines of school walls. Makerspaces can be found in schools, libraries, storefronts, and other places where the maker communities might thrive (Peppler & Bender, 2013). Proponents of Maker Movements argue that their appeal comes from a rejection by many people of associating their identity with the American culture of consumption. They choose, instead, to style themselves as makers and doers (Dougherty, 2013).

Makerspaces, creative learning environments that provide tools, resources and mentors for their members, have sprung up across the country (Swan, 2014). The origins of the movement included the founding of MAKE magazine and the rise of Maker Faire. Maker Faire is a series of events held all over the United States that attract up to 900 makers annually, who come to share their maker creations (Hlubinka, M., Dougherty, D., Thomas, P., Chang, S., Hoefer, S., Alexander, I., McGuire, D., 2013). Educators have noted the excitement around this movement and have adapted elements of it in classrooms, schools and libraries to support technology and science education. Students are attracted to these open environments stocked with everything they need to make real, working inventions that spring from their own desires and imaginations (Peppler & Bender, 2013). Perhaps the most important aspect of Makerspaces to explain their popularity is that they foster what Shirky (2011) calls intrinsic “interestingness”. Unfortunately,

"interestingness" is precisely the element that is lacking in many traditional classroom educational activities.

Beyond Hardware and Kids

Maker culture can be found in higher education settings, as well. The Georgia Institute of Technology, for example, boasts a 3,000 square foot Makerspace that serves 1,000 students a month. Students have an opportunity to prototype inventions before they enter the job market. Gone are the days when student engineers had to design their ground-breaking inventions in dormitory rooms and parental garages. Universities now supply the tools, and even classes and mentors, to assist students in these projects (Forest et al., 2014). University makerspaces can be managed by faculty, students, and/or or other university staff and typically include 3D printers, laser cutters, and electronics as tools for use by visitors (Barrett, T., Pizzico, M., Levy, B. D., Nagel, R. L., Linsey, J. S., Talley, K. G., & Newstetter, W. C., 2015).

What these Makerspaces have in common is that they are spaces that contain human and non-human resources that people can use to create objects at their own pace. Although classes might be offered in Makerspaces, the point of the spaces is for self-directed tinkering and inventing by users. A successful Makerspace values individual creativity in an atmosphere of collaborative advice and encouragement (Sheridan, K., Halverson, E. R., Litts, B., Brahms, L., Jacobs-Priebe, L., & Owens, T., 2014). Human resources can include mentors, experts, resource organizers and peers. Non-human resources might include machines, tools, consumable materials, and instructions, as well as artifacts created by other users for functional, educational or aesthetic purposes. In a Las Vegas Makerspace called the Syn Shop I visited, for example, members had access to 3d printers, a laser cutter, carpentry tools and machinery, metalworking tools, sewing machines, and electronics tools. Classes and skill-focused open sessions were advertised in the window and on the Syn shop website. A vending machine had been adapted to hold tiny Arduino-startup kits for sale.

The Maker Movement has also found its way into virtual spaces. Online digital media labs, media creation tutorials, photo and media collections and editing tools, and software lending libraries are popping up from public providers across the country (Carruthers, 2014). In my own workplace, an online university, a Makerspace would have to be comprised of virtual tools and resources and an online platform that can be easily accessed by interested students, instructors and staff. Since my area of expertise is American History I would begin with developing a virtual space where people could create the kinds of artifacts historians use to demonstrate their interpretations of past events and patterns.

Constructivist Learning Theories

Dewey (1938) argued that a teacher's job was to select "experiences" that support future educational activities and allow learners to transfer skills and knowledge from one learning task to the next. He recognized that much of what we learn is unintentional, and may actually be more important than the particular outcome expected by a traditional teacher. He believed the role of teachers was to guide the learner through the use of objects and materials provided by the school, much as the Spacemaker, the manager, provides resources and mentoring in the

Makerspace. Dewey maintains that teachers should create experiences that "arouse curiosity, strengthen initiative, and set up desires and purposes that are sufficiently intense to carry a person over dead places in the future." (p. 14). Unfortunately, classroom activities in typical classrooms all too often bore students and do not inspire them to continue their education in subjects taught in a traditional way. Makerspaces provide a place for more engaging and relevant experiences—and the community that meets to use Makerspace tools and raw materials can help fellow members over the "dead places."

The tools a learner works with as he/she learns are the essential items for development of learners, according to Vygotsky (in Van der Veer & Valsiner, eds., 1994). From the earliest ages, learners use tools and symbols (such as language) to negotiate their social environments successfully. Vygotsky believed that every aspect of behavior, either genetically driven or individually learned, was related to experiences a learner or his ancestors lived through and adjusted to. Unlike his contemporaries, Vygotsky did not view the learner as a vessel of completely self-directed growth, but, instead, attributed the learner's development to his mastery of the tools of his culture. The tools themselves carried cultural knowledge, just as the tools and resources in a Makerspace are relics of the arts they mediate. The Spacemaker and Makerspace members can provide supportive knowledge to assist the learner through the process of creation.

Papert (1980) imagined learning spaces much like those that Dewey recommended, with tools available to the learners that would connect learning to culture. He envisioned learning experiences without curriculum or lesson plans, built, instead, upon collaborations of ideas between teachers and students. He urged teachers to be aware of the cultures students bring with them to classrooms and use the most dynamic of cultural trends to engage students. Teachers serve as disseminators of cultural knowledge, and it is important that they bring a deep understanding and passion to the subjects they teach. In a Makerspace environment, fellow members support the culture and also stimulate and support passion.

Cognitive Tools in Learning

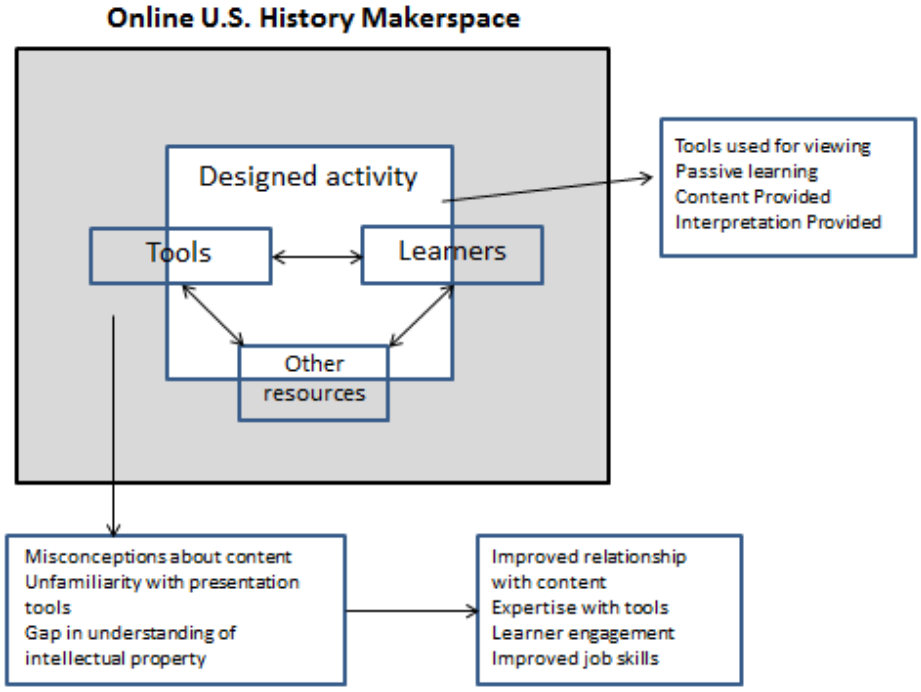
Papert (1980) held the computer, above all other tools, as way for students to create artifacts important to them. He lamented the early use of as presenters of information rather than creative partners in learning. Jonassen (2005) found himself lamenting the same issue twenty-five years later when he called for educators to eliminate the computer as a tool for teachers and hand them over to students for their own use. His notion of the computer as a cognitive tool was based on the idea that the learner could use the computer to construct an externalized representation of his own thinking, as well as create new knowledge with it. Kim and Reeves (2007) explored the advantages and disadvantages of cognitive tools, noting, like Vygotsky, that to learn, one must use the tools of one's culture as an integral part of the process. They advocated the use of computers for mindless, repetitive tasks, leaving higher-order thinking activities to human learners. In this way, learning was distributed between partners, the learner and the computer, each doing what it/he was most suited for.

Virtual Makerspaces

In the last few years, the Makerspace movement has extended to online settings. In a virtual Makerspace environment, the computer and software play the role of the tools one might find in an on ground Makerspace. Emphasizing the creation of knowledge over the consumption of knowledge, virtual makerspaces, the Spacemaker becomes a curator of tools and resources (Sannwald, 2017). Libraries are ideal locations for both physical and virtual makerspaces. University libraries, for example, have already augmented the resources and services they provide in a physical space with web-based access, but have added additional tools designed purely for digital use, such as those that can be used for searching, annotation, data mining, and visualization (Degkwitz, 2017). The growth of online universities presents even more potential for the use of virtual Makerspaces for learning. The online library is a natural host for a virtual Makerspace, but program areas could develop browser-based Makerspace platforms. In universities that provide computers to students, non we-based tools could be installed before shipment.

Making American History

The sources of history that historians once had to travel from library to library to study are available on the internet—photographs, letters, diaries, videos, music—and can be used in the virtual Makerspace for its members to view, read, reflect upon and also as raw materials in multimedia projects, akin to documentaries and websites professional historians produce, that members may want to create. I modified Kim and Reeves' Joint Learning System Performance Model to explain the change in relationship between the learner and the tools of History in the U.S. History Online Makerspace vs. learning U.S. History through an online history survey course. (Figure 1)



Learning performance system in the online U.S. History Makerspace (adapted from Kim & Reeves, 2007)

Whereas in a classroom students view finished multimedia projects, read books and articles written by historians, and prepare papers based on the topics portrayed through historian-produced media, in a history Makerspace they will learn to employ the digital tools historians use—computers and similar software. In a classroom, the computer is a viewing device, where the only tool used in a constructivist way is word processing software. In the Makerspace, members learn to use digital tools and resources in the same ways historians do, to construct representations of their interpretation of historical developments.

Historians "do" history by writing about materials and artifacts—primary sources—they find in museums, archives, libraries and in private collections. Most history enthusiasts, though, do not subscribe to scholarly journals or read monographs to learn about American History. They access the work of historians through popular media, documentaries, and internet websites. A U.S. History Makerspace could hold resources and tools its members could use to create their own writing pieces, videos, websites and possibly mashups or other mixed media forms to share their interpretations of the available sources. What would a virtual U.S. History Makerspace look like? What tools would be in it? What would students be expected to do in it? What would be the instructor's role?

Sylvia Martinez (Tech & Learning, 2014) described the spirit of the Maker Movement as "not a shopping list or special place, but as a stance towards learning that gives kids the tools and can-do attitude to tackle any problem they choose" (p. 28). In the U.S. History Makerspace,

what Vygotsky calls "tools," can be divided into three categories: authoring tools; sources (primary and secondary); and a platform.

I envision a Makerspace located in our Canvas Learning Management system, easily accessible by all students, that works like a wiki, with authoring tools and sources I imagined for the three basic project types in one place. Students would be able to choose which of the three types of projects they wanted to work on, or they could opt to do a mashup of two or more of the different types. The types of tools for use would also be expanded. Table 1 shows a sample of the types of tools that are available for each project area.

Table 1
Tools for US history makerspace

	Writing	Audiovisual	Website
Authoring tools	APA resources Blog post resources Wikipedia authoring tools	iMovie tutorials MS Picture Story tutorials Windows Moviemaker tutorials Mozilla Popcorn resources Animoto resources Free animation resources	Wix.com links and examples Weebly.com links and examples Webs.com links and examples Wordpress resources Html resources Joomla resources Wiki creation tools
Sources	• Wikimedia commons materials • Library of Congress collections • History.com resources		
Platform	Wiki in Canvas Learning Management System		

And what of the teacher/mentor? Kurti, Kurti & Fleming (2014) offer the concept of the Spacemaker in answer to the last question. They suggest Spacemakers act as mentors, not traditional teachers, and provide resources, questions, suggestions, and support. They should serve as role models by working on projects and collaborating with others themselves. The Makerspace would be open 24 hours a day, and the Spacemaker would plan to attend at scheduled times in a mentor role so students could work while the Spacemaker helped them strategize in developing their artifacts. Active members could also be asked to let new members know when they plan to be in the space, working with the tool and resources. When students graduate, they would be allowed to continue their membership. The membership would continue to be available to them freely, but they would be asked to assume the role of mentor as they work on projects in the Makerspace. This would meet Kurti, Kurti & Fleming's exhortation to Spacemakers to multiply their influence.

Conclusion

Makerspace theory and practice lends itself well to the online environment and the large number of free and low-cost tools available on the internet. What better place to create what Kargirogi & Symeou (2005) call a "phenomenarium" can be imagined? Offering these spaces

and tools in online spaces is a natural extension of the computer already sitting in front of the learner. Although Makerspaces have grown quickly in the areas of science and engineering, it is hard to identify an area of academic inquiry that could not benefit from this approach. Just as science and engineering tools and hardware attract certain types of learners, others will be drawn to Makerspaces that focus on art, music, history, and any other subject that can be imagined. Buechley & Hill (2010), in arguing for new types of Makerspaces to spread the influence of the maker culture, advise the development of new "clubhouses" that meet learners where their interests lie. A thriving virtual History Makerspace could create, where it did not exist before, interest and engagement in History, a subject all too often perceived as boring and unimaginative.

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