

Makerspaces in the High School Setting: The Student Perspective

Heather Moorefield-Lang, Ph.D.¹

Megan Coker, MLIS²

^{1,2} **School of Library and Information Science
University of South Carolina, Columbia, SC**

Abstract: Makerspaces, also sometimes known as fab labs or hackerspaces, are locations where students and patrons can produce, craft, solve problems, collaborate, and develop new skills (Preddy, 2013). The purpose of this study is to provide a look into the perceptions, both through text and image, of public high school students who have a maker learning space in their high school library at Monticello High School in Charlottesville, Virginia. The rationale for this research was that, by obtaining a better understanding of student perceptions and perspectives, librarians and peer researchers in the field would gain a better comprehension in how students view their makerspace. Individual one-on-one interviews with student participants were used to move toward a thematic analysis of perspectives of makerspaces in a high school library setting.

Keywords: Makerspaces, High School Libraries, Teen interviews, Creative projects, Visual ethnography

1. Introduction

Makerspaces, also sometimes known as fab labs or hackerspaces, are locations where students and patrons can produce, craft, solve problems, collaborate, and develop new skills (Preddy, 2013). They are places, both virtual and physical, where users can learn through experimentation, exploration, and play (Fleming, 2015). Makerspaces are areas where users can gather, share, and discover (Britton, 2012) and no two maker learning spaces are the same. Some have a focus on the arts, crafting, and expression while others feature a more technical concentration with circuits, robotics, and 3D printing. No matter the emphasis or the size of the space, the spirit and idea of making is the same; incorporating the tools and materials available and what can be created.

Maker learning spaces offer a wide range of learning opportunities for young people (Peppler et al., 2015). When based in school library programs the opportunities for integration expand even further. School librarians have the potential to collaborate with every teacher in the building, to instruct every student in the school, teaching the school population how to not only be good consumers but also smart creators (Fleming, 2015).

1.1 Purpose of Study

Research in the field of makerspaces is continuously growing. At the time of this writing, first person perspective, practical field advice, blogs, and popular media comprise the larger body of published work. Scholarly articles pertaining to this topic are growing in number while grant-funded research from providers such as the MacArthur Foundation and the Institute of Museum and Library Services will offer more research output in the future. The purpose of this particular study is to provide a look into the perceptions, both through text and image, of public high school students who have a maker learning space in their high school library at Monticello High School in Charlottesville, Virginia.

The rationale for this research was that, by obtaining a better understanding of student perceptions and perspectives, librarians and peer researchers in the field would gain a better comprehension in how students view their makerspace. Readers of this piece might also come to recognize the projects and activities that take place in these spaces as well as the challenges and successes that occur in maintaining such a program in a school library specifically through the eyes of the students.

2. Literature Review

Scholarly research on makerspaces is a continuous growing field of inquiry. Makerspaces in educational or school library settings is a lively but still small research area in comparison to others the fields of library and information science, with a selection of scholarly or peer-reviewed sources and more informal, first-person observations by teacher librarians. When exploring what resources are available regarding the maker movement and makerspaces in school libraries, it is therefore necessary to not only include those articles which specifically focus on that particular environment but also on related makerspaces which may have an educational focus even though they are outside of the K-12 educational system.

Halverson and Sheridan (2014) introduce the idea of making in schools including activities, people, and identities, which have contributed to its history thus far, and all of the questions and ideas they inspire now. Sheridan and Halverson notably express not only the goals of those involved in the maker movement in educational circles, but also their potential fears (what if the integration of making in institutions removes the spark and essence of the movement?) and how they may be addressed (focusing less on specific activities to be done and more on increasing student access to materials). In rethinking makerspace design and how it fits into educational communities, Halverson and

Sheridan assert that teachers and other peers in the field will also impact the conversation on learning, academic environments, and equity in education.

Still looking at makerspaces in education but not specifically in libraries, Sheridan et al. (2014) investigate makerspaces and subsequent uses with different populations. Focusing on the What, Who, and How of the three makerspaces through observations, interviews, and analysis, the authors examine if the spaces in their day-to-day interactions may serve as learning spaces and the different ways they are used by the communities they serve. Everything from the site setup to community members' roles and shifting levels of interest are included in this comparative study, showcasing how the little details all contribute to a making environment and learning experience, leading the authors to conclude that 'Learning is in and for the Making' (528).

Slatter and Howard (2013) look at makerspaces in public libraries. They assert in their study that the nature of makerspaces and benefits of offering this space and these services within the structure of a library is to potentially 'futureproof' libraries by increasing access to new technologies, new learning opportunities, and community engagement. The last benefit cited as the strongest, because through the makerspace new communities are formed over shared interests across multiple age groups and other demographic categories. While the authors acknowledge the challenges in creating and maintaining something new and unknown, they also highlight the pleasure expressed by community members over being able to explore this uncharted territory together.

Koh and Abbas (2015) insist that in order for makerspaces to remain viable, they must be equipped with support staff. The same values of service and access, which define libraries and motivate them to provide equipment and space for a learning lab or makerspace, should also influence information professionals to brush up their skill sets and lend a hand to those using the makerspace. However, what capabilities are required to provide resources and services in these learning spaces? Koh and Abbas recommend not only learnable skill sets like management, fundraising, program development, technology literacy, and the application of learning theories and user behaviors, but also a set of 'soft skill' competencies including the abilities to learn, to adapt to changing situations, to collaborate, to advocate, and to serve diverse people.

Loertscher, Preddy, and Derry (2013) offer one of the first articles focusing specifically on makerspaces in the school library environment, including concepts and framework behind makerspaces and a model for the users' goals in using the makerspace. The uTEC model of Using, Tinkering, Experimenting, and Creating show a progression in participants' objectives as they use the makerspace and expand their creative repertoire. According to Loertscher et al., as users become more familiar with tools and materials, they branch out further and try new levels of making experiences, until they potentially are creating their own items in their own methods. Ana Canino-Fluit (2014) also emphasizes

allowing the student to choose how far to pursue any project or problem they are working on to be empowered to think less like simple users or consumers and more like people who can tinker and fix things. She also highly recommends bringing in members of the community who can mentor students in learning particular skill sets.

As the current literature shows, makerspaces are occurring in public, academic, and school libraries. They are available in museums and communities at large. No two are the same, nor should they be, for each makerspace serves a different community and the needs of that population (Fleming, 2015). Currently very little makerspace research delves into the perspectives of patrons using the makerspace. This is a gap in the existing research and it is anticipated the following research will aid in further filling that void.

3. Methodology

For this research, individual one-on-one interviews with student participants were used to move toward a thematic analysis of perspectives of makerspaces in a high school library setting. Thirteen participants were interviewed for this study. In addition to student interviews, images and photographs of the makerspace and student projects have also been included in this study. Images create opportunities for researchers to further explain the experiences and knowledge of their research participants. Visual ethnography connects the ideas that exist between the literature and the participants in the current research study (Pink, 2001).

Setting

At the time of this study, Monticello High School's Library has had a makerspace for three years. Two librarians and one library assistant are the caretakers of this library space. The library also has student interns who serve in the title of 'geniuses', helping fellow students with technology issues while also using the maker learning area for their own innovation needs. This makerspace offers students two music studios, an open maker and innovation space for creation and making, a Lego area, and a green screen room for filming, as well as 'The Glass Room' as a classroom with glass walls where students can write and collaborate on the walls. The concept and idea of making and innovation are completely integrated into the school's curriculum at Monticello. Making is part of the library; it is part of the school's curricula, embedded in the framework of this public school, located in a college town. Monticello High School is located in Charlottesville, Virginia, home of The University of Virginia, so to say that this is an average high school would be an untruth. While this is a public high school, having a maker culture so ingrained makes it very different and separate from any high school we as a culture might see as 'normal'.

Sample

Purposeful sampling was used in this study. This particular type of sampling was preferable due to the purpose of this study, to better understand student

perceptions and perspectives of maker learning spaces. Students who had taken part in these learning locations would be the most likely to offer insights. Only students who attended a high school with a maker learning space were asked to take part in the interviews. A search was conducted of public high schools in the United States that had established makerspaces in their libraries. The term 'established makerspaces' meant having a makerspace or program in the library for a year or more. Interestingly the numbers were surprisingly small. At the time of the study, four high school librarians were responsive to our search. Many other high schools were in the planning and early stages of makerspaces in their school spaces and libraries. Once the designated schools were located, an email invitation was sent out to each school's contact librarian. Two librarians were willing to be involved in the research study but as the 2014 - 2015 school year continued the sample became less diverse due to attrition factors. Monticello High School, a public school in Charlottesville, Virginia, and the contact librarian, Ida Mae Craddock, collaborated to make this research project possible. The students interviewed, 13 total, were purposefully chosen from the school population as those who used the library makerspace, took part in creating projects in the maker learning area, or had been involved with the makerspace in a meaningful, curriculum-based way.

Data Collection

One researcher collected the one-on-one interviews as well as the images for the visual ethnography. Students as well as their parents signed consent/assent forms to take part in the study. Student names are excluded altogether from the study. Permission was given to include the library and librarian's name in the research. While makerspaces in libraries continue to grow in the United States, the numbers are still low. Keeping this school's maker learning program anonymous would have been very difficult. The consent forms included permission to share findings in research presentations and publications. Interviews lasted between 15-20 minutes. The interviews were digitally audiotaped (with participants' consent) and then transcribed by the researchers.

All collected images took place during on-site visits to Monticello High School. Photographs of makerspaces and student projects were gathered during the visits. Students were either not captured in the images or the photographer ensured that student faces could not be seen or recognized.

Interview Questions

Gender and grade level were the only demographic questions asked during this interview process. The focus of the interview protocol was on the high school makerspace, projects, challenges, successes, reflections, and student insights. A sub-sample of the questions asked were analyzed for this study. Two questions in the protocol focused on 3D printing and projects with that technology. Very few students interviewed had experience with the 3D printing equipment and could not give answer to those questions. The sub-sample of questions analyzed for this study are:

- R1. How often do you come to the library to use the maker space area?
- R2. What do you think of the maker space?
- R3. Do you have any projects that you have done in the maker space or with the 3D printer? Can you tell me about them?
- R4. Were you here before the maker space was placed in the library? In your opinion, what are some of the differences? Good or bad?
- R5. Do you have a favorite part/section/station of the library maker space? Why?
- R6. Do you find any part of the maker space challenging, difficult, or hard? Why?

Data Analysis

Both authors of this piece completed data analysis. Text data were analyzed using NVivo 10 qualitative data analysis software. Student interviews were imported into the software and common themes explored throughout the 13 interviews. Visual data were also gathered, connected, and labeled to the common emerging themes within the research. Some common themes included projects in makerspaces, challenges, perceptions, and student reflections of the maker learning space.

4. Results

Interview respondents were students attending Monticello High School who had participated in activities in the school's makerspace. Thirteen students were interviewed; six of the students were male and the remaining seven were female. It was important to gain perspectives from students who had been involved with the makerspace since its inception. With the maker, learning space having been in the school for three years no first year students took part in the interview process. Out of the thirteen students interviewed, two were sophomores or in the 10th grade, one was a junior in the 11th grade, and the remaining ten students were seniors. The older students having the most experience with the school makerspace.

Favorite Location in the Makerspace

The makerspace at Monticello High School has multiple components and spaces included in its makeup. Students can create recordings in two separate music studios. They can build, make, and create in a designated open makerspace. The makerspace has a classroom with glass walls creatively called The Glass Room, a space educators can reserve for class and where students can write and design on the walls. Connected to the library is a classroom known as The Hackerspace complete with green screens for filming, glass boards for writing and designing, and comfortable seating for collaborative work and planning. The final component of the Monticello Makerspace is the Genius Bar with student aids and librarians to serve and meet the needs school community. When asked about a favorite space in the maker learning area, one student offered the following:

Probably the Hackerspace, that's probably the newest space, it has a very modern feeling. I'm pretty sure there's some couches, some bean bags, there are tall tables with tall rolling chairs, then there are shorter tables. I like the feel of it, it feels very professional, I guess, like you're in an office or something, not like you're in some dingy high school classroom or something. My favorite thing about this school in general is that there is light and that there are windows everywhere and there's a window in that room and so it's just bright and enthusiastic.

The process of students learning through making stretches across the division of formal and informal learning (Halverson & Sheridan, 2014) and having a space or spaces to feel comfortable enough to take part in that learning process is important. Another student enjoyed sharing his work from The Genius Bar:

I prefer the genius bar because you go back there and you don't get interrupted as much... The genius bar gave us the ability to sort of show our products, you could leave it out on the table and people sort of respect the idea that you don't touch it but you can ask about it. It's easier to show off your projects because otherwise you would have to store it somewhere and storing it in a cabinet where no one can really see it or see what it is. The genius bar added a collection point for sharing our projects. (See Figure 1)



Figure 1. Drone Created by Student (Work in Progress)

The school librarians at Monticello have used the library space to enhance student curiosity and support learning and creativity. By using the area in this way and offering maker activities to students there can also be an increase in feelings of capability and confidence (Small, 2014).

Student Perspectives of the Makerspace

Monticello High School runs on a block schedule; students have alternating sets of four daily classes, which are 90 minutes each. Because there are fewer classes per day, each class is allowed a longer period. Interviewees viewed the library and makerspace as one space; all thirteen visited the maker learning space every week and all but one visited the makerspace every day. One student had the following to say about the library maker area:

I feel like the makerspace is an escape for all students. When we're in the hall, when we're in class it's just like work, work, work, but when we come to the library, I mean we work, but nobody is down our throats, it gives us our own space to do what we have to do. And they make sure we get it done but they're (teachers, librarians) not breathing down our backs.

Makerspaces turn a library into a location where students are not strictly consuming; they are creating (Fleming, 2015; Slatter & Howard, 2014). At Monticello, students feel open to make, create, and collaborate with their peers. They want to come to the library, they want to fill the space and generate. In the *Maker Movement Manifesto* by Mark Hatch (2014), making is the first component of his listed philosophy. Hatch believes that making is an essential component to being a human being. In order to be whole we must make, communicate, and produce. The following students would agree with Hatch's ideas as well:

I think it (the makerspace) is great, I guess most students don't get the chance to bring out their creative side, like on Pinterest they have DIY projects and all that stuff, but if you don't have the materials.... But if you have a makerspace, you have those materials--robotics, markers, crayons, just everything, whiteboard...I think it gives kids a chance to bring out their creative side when they don't have an opportunity to do that. (See Figure 2)

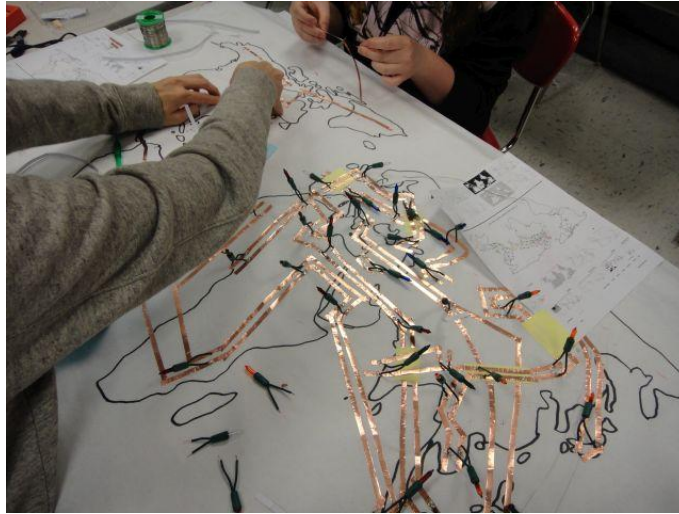


Figure 2. LED Circuit Map of World Religions (Class Project)

Projects

When a makerspace is part of a school library it is important to integrate the space and activities with student learning, peer educator curricula, as well as information literacy. Projects in a school library makerspace can come in the form of class projects, student learning centers, open exploration, clubs, and much more. Some libraries have coding and crafting, others will have hands-on technology time with 3D printers and circuits, while still others will focus on one project or activity at a time (Moore, 2014).

At Monticello, students had both class-related and independent projects. One student describes his independent school project in the following statement:

Part of my independent study was for the robotics team, we applied for a grant where you had to design a piece in a 3D software that you would use. The grant was for a 3D printer and you had to design a piece that you would use and make out of the 3D material. So I designed an on/off switch plate for the on/off button for our robot and I made it so you could mount it to our robot and different things like that, which was cool, and then we actually made it on one of our 3D printers which was really fulfilling. We won an award that was related to that and we won the grant, the 3D printer as well. (See Figure 3)

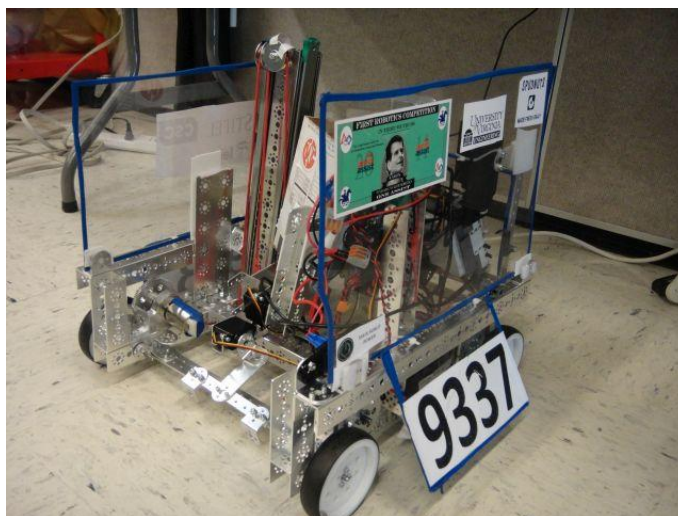


Figure 3. Robotics Team Project

Each and every makerspace is going to look different and the activities and projects are certainly going to be diverse but the potential for collaboration between students as well as the partnerships that can be formed between the librarian and peer educators is incredibly powerful (Pisarski, 2014). A space for making is also one where students, sometimes along with a parent, teacher, librarian, or peer student, can make, solve problems, and enhance skills (Preddy, 2013). One student shared his story about a personal project in problem solving in the following statement:

I have a brother that is deaf and there's a problem with where he can't hear what he is doing and he is often very loud so he will slam doors or throw things or whatever because he doesn't know that it is loud. So I made, I was working on, I'm still working on it, a machine that is belt clip size that he just can just wear on his belt and it detects noise and it transfers into vibration. So the louder something is the more it vibrates and that way he can get a little bit more of an idea of when, if he slams a door, it will vibrate and it will alert him to that was really loud, maybe I shouldn't do that again or maybe I should be quieter next time or whatever.

Young makers and innovators find that creating and manufacturing is highly rewarding not only for the creation aspects but also in the realm of problem-solving. It is incredibly satisfying to come up with a solution to a conundrum or challenge especially if this helps someone else makes their lives easier (Small, 2014).

The Library Before and After the Makerspace

Maker learning spaces began to emerge in libraries in 2012, first in public and academic libraries then at the school library level. Leslie Preddy (2013) in her book *School Library Makerspaces* discusses how school librarians and their libraries are continuously changing to meet the needs of their specific community of learners. Makerspaces offer an active learning location for students to solve problems and think critically.

Most students who have a maker learning space in their school library will remember the site before the makerspace was integrated into the program. At Monticello High School, the makerspace has been part of the library community for three years. Some interviewees had witnessed the maker area from birth to its current status. One student, a senior, had the following to say about the library before and after the maker learning space became part of the library:

So the makerspace was conceived and started during my junior year of high school so I had been in here two years before it was started. When the makerspace came up it was sort of a collection point for people who had these interests in the past but never really had a means of divulging them throughout the school in the past, this was sort of a first....This is the sort of place, the first time we have had the maker ability within the library and it sort of trickled out throughout the school... It didn't just change the library it changed the mentality of the whole school it seemed. Instead of saying we can't do that because we don't know how, it's we can do that, how can we figure out how to do it.

By their very nature, libraries are an interdisciplinary epicenter for a school, university, or community. These are the places where ideas and learning can meet (Kurt & Colegrove, 2012). Makerspaces create even more cross-discipline opportunities and no matter if they are here to stay or if they are a passing fad, making and learning will change the way knowledge is produced, and how services will be offered in libraries.

5. Discussion and Further Research

Monticello High School is a very unusual location. This is one of the first high schools in the United States to have a makerspace and at the time of this research, the makerspace was in place for three years. Having a maker learning space and culture in a school library with librarians and teachers incorporating the maker ideals in information literacy, research, and curriculum, as well as students filling the library daily to use the makerspace for their personal and school-based projects, is not the norm. The students interviewed are also not typical; with access to the spaces and technology available to them in their maker learning area; these are young people who are going to be ahead of the curve upon entering university. This shines a light on those who do not have these opportunities.

This research study focuses on high school students. As stated in the methodology only one high school was able to participate due to attrition. More than the 13 student perspectives from this research piece are needed for a further robust understanding of maker learning spaces in school settings. Looking at students who have a maker learning space and choose not to use the technology and options therein would make for intriguing research. Perceptions of students at the middle school and elementary levels would be valuable. Case studies in how making is integrated into middle school and elementary school curricula would also be a strong addition to the field of research. Currently, as the empirical body of research in this field continues to grow, adding to the body of inquiry is necessary and needed.

6. Conclusion

While there is more research to be done regarding the use of maker learning spaces in educational settings, there is also much to be learned from a single case study of student perspectives on the implementation of a maker learning space in a particular high school. Through an examination of interviews with participants and images of their activities using different areas of the makerspace, this study explores the real-life significance, use, and challenges of a maker learning space integrated into a school library. Using personal examples of problems, interactions in the learning maker space, and projects (personal and class-related), interviewees showed awareness of a distinct difference in personal processes, interest levels, hands-on learning, specific skill sets, and the library environment before and after the maker learning space was created. Further research into this illuminating area of inquiry is highly recommended.

References

- Britton, L. (2012). The makings of maker spaces, part 1: Space for creation, not just consumption. *Library Journal*. Retrieved from <http://www.thedigitalshift.com/2012/10/public-services/the-makings-of-maker-spaces-part-1-space-for-creation-not-just-consumption>
- Canino-Fluit, A. (2014). School library maker spaces: Making it up as I go. *Teacher Librarian*, 41(5), 21 - 27.
- Fleming, L. (2015). *Worlds of Making: Best Practices for Establishing a Makerspace for Your School*. Thousand Oaks, CA: Corwin.
- Halverson, E.R. & Kimberly Sheridan. (2014). The Maker Movement in education. *Harvard Educational Review*, 84(4), 495 - 504.
- Hatch, M. (2014). *The Maker Movement Manifesto*. New York: McGraw Hill.
- Koh, K. & Abbas, J. (2015). Competencies for information professionals in learning labs and makerspaces. *Journal of Education for Library and Information Science*, 56(2), 114 - 129.

Qualitative and Quantitative Methods in Libraries (QQML) Special Issue: 59
School Library Research and Educational Resources:6: 47-59, 2017

- Kurt, L. & Colegrove, T. (2012). 3D printers in the library: Toward a fablab in the academic library. *ACRL TechConnect Blog*. Retrieved from <http://acrl.ala.org/techconnect/post/3d-printers-in-the-library-toward-a-fablab-in-the-academic-library>
- Loertscher, D.V., Preddy, L., & Derry, B. (2013). Makerspaces in the school library learning commons and the uTEC Maker Model. *Teacher Librarian*, 41(2), 48 - 51.
- Moore, C. (2014). TEA time in the library: Creating a makerspace for tweens. *Children and Libraries*, 12(3), 17 - 21.
- Peppler, K., Maltese, A., Keune, A., Chang, S., & Regalla, L. (2015). The maker ed open portfolio project: Survey of makerspaces, part 2. Retrieved from http://makered.org/wp-content/uploads/2015/02/OPP_ResearchBrief6_SurveyofMakerspacesPart1_final.pdf
- Pink, S. (2001). *Visual Ethnography: Images, Media and Representation in Research*. Thousand Oaks, CA: SAGE.
- Pisarski, A. (2014). Finding a place for the tween: Makerspaces and libraries. *Children and Libraries*, 12(3), 13 - 16.
- Preddy, L. (2013). *School Library Makerspaces: Grades 6-12*. Santa Barbara, CA: Libraries Unlimited.
- Sheridan, K., Halverson, E.R., Litts, B., Brahms, B., Jacobs-Priebe, L., & Owens, T. (2014). Learning in the making: A comparative case study of three makerspaces. *Harvard Educational Review*, 84(4), 505 - 531.
- Slatter, D. & Howard, Z. (2013). A place to make, hack, and learn: Makerspaces in Australian public libraries. *The Australian Library Journal*, 62(4), 272 - 284.
- Small, R. (2014). The motivational and information needs of young innovators: Stimulating student creativity and inventive thinking. *School Library Research*, 17, 1 - 36.