Maker Corps Case Studies

2016 EVALUATION REPORT

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EVALUATION ACTIVITIES 2016

Maker Corps is a program delivered by the Maker Education Initiative (Maker Ed) to increase organizational capacity to develop and deliver maker programing. Since its inception in 2013, the program has grown to support over 100 organizations by providing professional development, connections to a community of other maker educators and individualized support. Over time the program elements have changed in response to feedback from participants, collaboration with evaluators and shifts in focus for Maker Ed's goals. In the spirit of maker education — tinkering, observing, responding, iterating — Maker Ed has continued to commit to program evaluation. In 2016, evaluators at the Science Museum of Minnesota conducted four evaluation efforts:

1. Revision of a program Logic Model
2. Pre- and Post-Surveys of Maker Corps Members and Partner Site Supervisors
3. Case Studies of three veteran sites (participants in 2014, 2015 and 2016)
4. Follow-ups with three Case Study sites featured in 2014

The broad goals for these efforts were to understand how well the Maker Corps program meets its participants needs, identify ways in which the program could be modified and describe the impact participation has had on organizations.

Specifically, the guiding questions for these efforts were:

1. What is the underlying theory of change for organizations who participate in Maker Corps? What attributes seem to influence how Maker Corps impacts the organization?
2. What are the lasting impacts on organizations after participating in the Maker Corps program? Are there differences by types of organizations or length of participation?

> **Maker Corps Program Description**
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> *Maker Corps is an online professional development program that provides training and a community of support to youth-serving organizations as they design and implement summer maker education programming.*

What follows is a summary of the commonalities among the Case Study sites from 2014 and 2016 that reveal effective ways that organizations use Maker Corps to grow their organizational capacity and networks of partner organizations.

	2014	**2016**
Library	Millvale Community Library Millvale PA	Keene Public Library Keene NH
School/ School Residencies	REM Learning Center Miami FL	Progressive Arts Alliance Cleveland OH
Science/ Technology Center	Science Museum of Minnesota St. Paul MN	Digital Harbor Foundation Baltimore MD

SHARED VALUES AND BELIEFS ABOUT MAKER EDUCATION

The educators and leaders at these organizations approach this work with a remarkable degree of shared philosophy about the propose of maker education and its relevance to their work. Their settings, audiences, and disciplinary focus differed but at their core were shared values that guided their program development. While it seemed that prior experience had formed many of these values, maker education enabled them to express these values through their work and be supported by similarly passionate individuals.

Maker education is for everyone – and cost should not be a barrier for participation

Despite the differences in organizational type and funding structure, all of the case study sites believed very strongly that their audience should not pay much – if anything at all – to participate. For the libraries, that was core to their institutional mission and history as a public space open to all. At REM, students did not have to pay extra to participate in maker activities and PAA delivers their summer programming in free library programs. The Science/Technology centers were creative in finding solutions to make their programs available to all; SMM hosts its Play.Tinker.Make program on Saturdays at tables set up throughout the museum, DHF asks participants to pay what you can. In other words, making education is not exclusive, and these organizations have sought ways to make their programs available and accessible to all.

Maker education is better with partners

These organizations also recognize that their programs will reach more participants if they partner with other organizations to provide programming at other sites or professional development for their staff. They understand that reaching their site, whatever it may be, can be a barrier for participation, and that those who have the means to seek out their programs should not be the only recipients.

They also believe that partnerships can strengthen the work they do onsite. They invite feedback and value learning from others about how their programs can be improved or modified.

It's important to highlight that they are considered true partners by other organizations. Yes, the case study organizations provide programming and professional development to others (a service), but they adapt and are flexible with what they provide. Of the organizations I spoke with that partner

with the 2016 case study sites, all mentioned how much they appreciated them for custom designing experiences for their audience. Becky Ranallo at the Cuyahoga Library, a partner with PAA, said, "We love that we can go to Santina with the vaguest of ideas, and she'll be like, 'Yeah, sure, let me talk to my staff.' And then they come up with this amazing program from it."

Maker education is an approach to learning, not just new tools, materials or technology

Other local organizations approach these organizations because they value their expertise in this newish educational field. Many partners spoke about how these organizations have an understanding of new technology and materials that they don't yet have fluency with. However, the case study organizations often pushed back on the notion that the movement is all about technology and tool use – rather, the self-directed learning, open-ended problems solving, peer collaboration and other maker education values drive their programs.

Maker education experiences should be developed, delivered and evaluated with rigor

Despite the difference in organizational type, content focus and audiences, staff at all the case study sites agreed that maker education programs needed to meet their high standards for educational experiences. Staff used the words "rigor" and "quality" to describe their making programs. Many sites have a deep interest in understanding how maker education experiences can be evaluated and youth development documented.

Maker education is about trying things out, not having complete knowledge

The leadership at these organizations practice what they preach – making is all about trying and failing and looking for support. While they feel confident that what their programs offer is valuable, they by no means suggest that they have it all figured out. They approach new programs, projects and materials with the same spirit they learned from Maker Corps. As Gail at Keene Public Library put it, "I learned to just try things!"

ORGANIZATIONAL IMPACT OF PARTICIPATING IN MAKER CORPS

Provided staff with valuable professional development

While the staff at the case study sites felt they had personally gained a lot from participating in Maker Corps, they agreed that their biggest gain was during the first year of their participation. After that, they felt they knew Maker Corps was a trusted organization that could provide their other staff and Maker Corps Members professional development and support that they knew to be of high quality. Many sites provided their MCMs with additional mentorship or training to help them succeed in their setting. For example, at SMM, Maker Corps Members received leadership skill development in partnership with their Youth Science Center.

Tested out program ideas in an intensive and highly supported structure

Almost all of the case study sites use the summer to pilot school-year programming, and Maker Corps is an ideal structure for staff to try different ideas in a very supported environment. However, some sites might find translating their projects from informal to formal educational settings challenging.

Supported documentation practices and opportunities for sharing

To reinforce the spirit of sharing in the maker community, many sites required that their Maker Corps Members document their work on the Maker Corps community page and within the organization's own systems. For example, at SMM, Keith arranged for his Maker Corps Members to be videotaped demonstrating the projects they created, including comments about how to facilitate the project. Keith also gave his MCMs a small budget to buy materials of their choosing and come up with their own project ideas that were shared at weekly staff meetings.

Increased internal buy-in of program

Being aligned with the leading national organization to support maker educators was important for convincing leadership of its value and legitimacy. Possibly because maker education can seem hard to define, it helped organizations gain the trust of colleagues and leadership that their efforts were being guided by structure and standards.

Made connections to other maker educators

As a result of participating, case study sites said they had made connections to other maker educators, but the most meaningful connections were made in-person at conferences, Maker Ed sponsored events, or local gatherings. The online community and resource center were helpful to learn about what others do at their site but less helpful for establishing lasting relationships.

Developed valuable programming to offer other organizations

During the first summer of Maker Corps, most organizations had started to make connections to other organizations, but not yet working together. By the second or third summers, the case study sites were able to offer others either programming or professional development support. These partners highly valued their expertise and leadership in this area.

WHAT'S AHEAD FOR VETERAN ORGANIZATIONS

These six organizations now have several years of experience in the maker education field, and are moving ahead to new phase of their own needs for professional development and support. While they may feel confident in the programming they have developed, they are often still a local pioneer that other organizations look to for guidance and leadership. This role can feel a bit isolating and at times overwhelming, so continued support from a national network for other maker education organizations is valuable.

Expanding Partnerships and Outreach

At this point in time, may of the organizations felt confident in what they offer for maker programming. Now they would like to reach more people, in more places, through more partnerships. A big part of this is finding ways to fund that work, through grants or fundraising. Finding the right

funding agencies and donors to support maker education had been a slow process for some, and they are looking for guidance on where to direct their energy.

Focus on supporting specific audiences

The case study sites all recognized that their core audiences usually come to their programming with a maker mindset or interest already established. They would like to expand their impact to audiences that may not naturally gravitate towards their programs or may need additional boosts. For example, DHF spoke about working on supporting female makers and Keene would like to reach library patrons who are not already engaged.

Continuing dialogue with other maker educators

All of the sites offer year-round programming and seek a community to have ongoing dialogue about their programs. Many have found what channels work for them already, such as Twitter or the ASTC Community of Practice. This community would serve a different function than their local community of partner organizations, with which they have more of a service/provider relationship. They seek peer organizations who understand the nitty-gritty of running programs, finding funding, promoting their work, and playing with new technologies. In addition, they are looking to continue their own professional development and offer their staff professional development to help them continue to be a learning organization.

Maker Corps Case Study
KEENE PUBLIC LIBRARY, KEENE, NH

> **Keene Public Library Mission Statement:**
> *To provide free, open, and convenient access for all Keene residents to acquire information for growth in their personal knowledge; for life-long learning and enjoyment; for the fulfillment of informational needs, desires, and curiosities; and for enhancing quality of life in the community.*
>
> http://keenepubliclibrary.org/
> http://www.kplcampaign.org/

Maker Corps Contact: Gail Zachariah, Head of Youth and Community Services

Maker Corps Members: Yves Gakunde, Quinn Lonchierk-Renehan, and Maureen Meyer

Years in Maker Corps: 2014, 2015, 2016

What's in the mix

- Administrative support for and community interest in maker programs
- Vision for libraries as places for playful and creative learning experiences for kids and families

What's ahead

- Attracting makers to work and volunteer in the library
- Finding funding to increase programming and capacity through the school year
- Making more connections between local organizations (college, K-12 schools, other youth-serving organizations)

Maker Education at Keene Public Library

Like many small town libraries in the U.S., the Keene Public Library is a community hub valued by many people for many reasons. As the biggest library in the region, the library served over 25,000 people in programs during 2015-16, offering events for youth, families and adults. There are book clubs, writing clubs, movie nights (and Saturday morning cartoons with cereal), game nights and coloring parties – and that is in addition to circulating 278,000+ items per year. The library offers

resources in print, audio, digital formats and is constantly adapting to new technologies. Many patrons visit the library for their high-speed internet service in an area that is underserved with broadband access. Others come to get away from technology or to participate with others; the staff believes the library needs to accommodate all their patrons' needs.

The depth of offerings reflects the library's commitment to responding to the needs of their community, but also the interests of their staff. Gail Zachariah, the Head of Youth and Community Services, previously worked in children's museums and believes libraries should offer playful and active learning experiences with engaging toys. The maker movement was a natural fit for her philosophy and her own personality; as she put it, "As a librarian, you need curiosity… and [with maker education] there's really no boundaries."

Nancy Vincent, the Director of the Keene Public Library for over 30 years, was in complete support of taking on this focus. Both Gail and Nancy agree that maker education (the tools, technology and philosophy) is "of its time." Nancy explained, "People want to do it. It's also open to everyone. They are producing stuff people don't have access to, engaging in collaboration and creativity and design. People of all ages want to create things." Of particular importance for them is the accessibility the library provides for people to have their first experience with new technologies or materials. They situate their offerings in contrast to the for-profit makerspaces in the region that mostly appeal to adults and charge a membership fee.

> **"If we didn't do [maker education], then the library would not be as well-rounded. Our mission is a really old-fashioned mission…But ours has the word 'curiosity.' … To me it really fits because if you have an interest but it's not really precise, you just want to explore, and people can explore things by using, and building, and not only just through books. … So I think without doing that, we'd have a much more limited library that wouldn't be as interesting or fulfilling." – Gail**

Developing their maker program

Nancy noted how impressed she has been with Gail's tenacity and ability to gather resources to build the program. Part of her drive is the very curiosity that is embedded in Keene's mission. As Gail put it, "I learned to just try things. … I've kind of taken on the idea that, you know I should just try it, tweak it, do it again, kind of treat it like a making kind of experience as well." Over the past three years, Gail and her small staff have developed and delivered maker programming inspired by others (especially through the Maker Corps message boards and Maker Ed's resource library) and finding what works for them and their space.

Connecting with Maker Ed to get guidance on how to begin – and now sustain – their programming was key. Gail said, "We applied [in 2014], because we thought it'd been really helpful for us to have the authority and the name, and for the community to be able to say that we're connected with Maker Corps, and for ourselves to feel like we're confident in what we're doing." She has found the

name recognition of Maker Ed to be very helpful in advocating for the programming to the Friends of the Keene Public Library (which funds the programming) and attracting Maker Corps Members.

Gail's persistence and infectious curiosity has contributed to the maker approach becoming a part of the library's future. The Keene Public Library is set to expand into an adjacent building in the next few years, and a makerspace is part of the plan (see the latest at: www.kplcampaign.org). Seeing that on the horizon has motivated Gail to continue to be involved with Maker Ed. As she said, "I want more people to feel more comfortable so that when that happens we'll be able to meet the demand." In addition to a makerspace, Gail and Nancy are excited about more spaces for patrons to actively collaborate in-person and virtually, another way of supporting the maker philosophy of sharing and learning from others.

In a recent article Gail wrote for the local *Parent Express*, she describes the maker movement as "a technological and creative learning approach that builds upon the power of learning by doing. Maker programs involve real tools and hands-on experiences combining art, electronics, programming and computational mathematics together in meaningful, powerful ways." She feels that these values are important to the local community, which has roots in manufacturing and is currently trying to attract new business and employees. Those companies, "have been expressing they have had a big challenge, because even though they want to pay a lot of people a lot of money, they can't find anybody... willing to work for them with math and the spatial skills," she said.

Maker Corps at Keene Public Library

Gail has used the reputation of the Maker Corps program as leverage to attract people not from Keene, as well as entice local professionals and students at Keene State University to spend their summer at the library. During the summer of 2016, three Maker Corps members participated.

- Quinn is a recent graduate and of UMass Amherst's Science Education Master's program and entered a teaching position in August. He is excited to encourage his students to become producers with technology, not just consumers, and to share their creations. That said, he's also wary of using technology just for technology's sake. ("I am sort of trying to think about only using technology if it's really changing things," he reflected.) For him, maker education makes perfect sense in a library, but also feels a responsibility to help people have a meaningful experience: "[Libraries] have always had the books that you could come and read and get the knowledge, so it makes sense that they have these gadgets that people might not be able to access at their house…. But I still sort of struggle with the tools. I really want to try to use them in a way that's challenging and provides some critical thinking."

- Yves is a current doctoral student in Environmental Studies at Antioch College, who has been doing programming at the library for the past four years. He believes that learning how to persist through challenges and planning before jumping into projects are key lessons that come out of maker programming – and are skills that young people need to develop. He reflected that as a result of helping with maker programming, he has become more planful when he takes on creative projects. He is especially excited about the library's future as a community building space.

- Maureen is a K-5 librarian at a local school. She has been working at the library for the past 21 summers, and has happily surprised at how young kids can participate and work with technology. She said that doing the programs has helped her to "get it" and she has also

done some activities on her own — even when they were confusing and frustrating. She credited Gail with encouraging her to figure it out despite those challenges and being an inspiration for just "figuring it out." She said, "Gail jumps in with both feet on so many things."

A peek inside the program

On a Thursday afternoon in August, the Keene Public Library's basement was buzzing with activity. Literally buzzing. A 3D printer whirrs in one corner, kids are building pie-plate UFOs, and tiny LED lights are flickering on and off as kids tinker with making copper-tape circuits. There are five stations altogether; something for everyone. Each Maker Corps Member is adding in their own perspective as they work with students. Maureen gently guides a family in building their circuit, aware of how challenging simple tasks like cutting and folding paper can be for young kids. Yves mentions how he is always trying to slip more science concepts and terminology into his conversations with kids and families.

Quinn works patiently and confidently with young patron to guide him in making his first 3D object. The boy wants to make the White House, where he has recently visited with his family. He makes a rectangle and then a dome on top. "Looking great!" says Quinn. "Hmm. What else does the building have? Can we figure out how to make some columns?" Quinn shows the boy a few tricks in Tinkercad to get him started and then watches as the boy carefully places four recessed rectangles in the front. He's ready to print. Walking out holding his miniature White House, the boy says, "I can't believe I made that."

Sustaining their maker program past summer

During the school year, there is just as much interest in maker programs but currently the library doesn't employ additional staff to support those programs. Their 3D printers and limited number of computers are available for use but it is challenging for Gail to be available to support users and keep all the technology up-to-date. For these reasons, Gail has pushed her Maker Corps Members to document their work and the projects activities they created so that she and the year-round staff can learn from them.

Gail feels a certain amount of pressure to grow their maker offerings because of the new building. Currently there is no funding for paying new staff when the space opens, but Gail hopes to advocate for that by demonstrating all the impact their programming has already had on the community.

Learning from Maker Ed and the Maker Corps Community

Maker Ed was Gail's first relationship to the maker education community and continues to be the most influential. "I learned a lot from them. Especially the approach to teaching, more than about the problem itself. …Steve [Davee] talks more about the way to present projects and things," she reflected. That personal connection has remained important to her. As the organization and Maker Corps program has grown, Gail feels that some of that personal relationship has been lost. "The first year we were on they had a lot more training sessions. It was hard to get to them all. But you got to see people's faces. [The online community] is just a little bit harder," she said. She added that she doesn't feel like she knows people as well. For her, a library affinity community isn't necessarily important to her because of the difference in programs, scale and resources from place to place.

Quinn learned about Maker Ed during his graduate program and found out about the Maker Corps program through their Twitter feed. Their reputation was one reason he applied: "[Maker Ed is a]

really good organization, lots of really good resources, of which I've already started taking advantage of before this. I saw the opportunity to be sort of aligned with them, and so thought that was definitely a good thing." Quinn especially talked about using the online community

Outreach and Collaboration with Community and other Organizations

The library is currently the only provider of maker programming in the region that is free to youth and families. Gail has made connections with other youth-serving organizations including the Housing Authority and YMCA to both host them at the library and send her Maker Corps Members out to their sites. Samantha Hill, the YMCA School Age Coordinator & Camp Director, was looking for STEM experiences for her 11-14 year-old Counselors-in-Training in the summer of 2015 and came across the library's maker programming. She was really impressed with the activities and appreciated how it gave her a refresher on hands-on science activities, too.

This year, Gail reached out to her even before Samantha had started planning, and arranged to bring programming out to about 60 summer campers. Samantha's program budget is very small, so she is always looking for inexpensive projects or outings. This summer, Quinn came out to their camp and brought several different projects that engaged all ages, which was important to Samantha. She said, "They really did like seeing Quinn, having those different science projects and being able to be a part of that. That change of pace; of being like 'Oh cool, Quinn is under a tent with something and we don't know what he's got.' Perfect. I think it's more the curiosity and 'Oh, what's he going to bring next time?'"

> "When [Quinn] brought like the batteries and the robot, I heard kids start talking about different batteries. One little boy was talking about a battery in a car. That's now a thing that they are talking about and they are engaged and they want to learn more about it. They're asking questions, and we're like 'Let's see, I may not know that but we can go test it out and see what that means.'" — Samantha Hill, Keene YMCA

Samantha also has trouble finding staff for her programs during the school year. Her need is from 3-6pm, when many people are unavailable. It's important to her for her programs to be fun as well as educational, which she feels like is an easier balance to strike when someone else delivers the program. She explained, "We also like to make sure that afterschool is not school so it's definitely kids learning without them realizing they're learning and teachable moments."

Samantha has picked up new skills for how to create that programming on her own from participating in the library's activities. She said, "I actually took a lot of the stuff that I learned in what the kids made and I would make with them and then I put it in a folder and I wrote down some stuff about how to make those things and questions to ask. We made a weighted washer, like a bird thing. … and I thought, 'I'm gonna do this and then we can go into weights and washers and then we can bring it into using magnets.' We did that at the beginning of the year and I was fresh from it and I liked it because it gave me some new ideas.'" She is interested in collaborating with Gail and her staff on identifying projects to support themes that her youth want to explore during their afterschool clubs.

Funding Maker Corps and Maker Programs

The funding to pay Maker Corps Members and offer maker programming comes from the Friends of the Keene Public Library. "The fact that we're connected to national organization that is going to be guiding us makes a difference to them. [I explain that] Maker Corps is [professional] development and it's helping us getting ready for the new building," Gail said. While that support is much appreciated, she feels like what they can pay for Maker Corps Members is insufficient to support people to relocate to Keene for the summer. She found the 2014 Rally.org campaign useful, although the total amount they raised was only a few hundred dollars. To raise even more funds, Gail thinks it will be necessary to better document the impact of their programs. "But I think that people who might be donating money or volunteers, they make they want to make sure that they are getting involved in something that is proven that it is successful," she said.

Building their maker program

Gail would like to see more patrons get involved in the making programs; she suspects that her programs attract people that are already familiar with maker or STEM learning. One solution Gail has thought about would be to offer a year-long Maker-in-Residence program, where the library would host a maker for an entire year to develop and deliver programming. This would help address two of the library's needs: new ideas and talent from outside the local region and more programming. It might also help support the development of longer-term projects, something both Quinn and Yves discussed as a way to deepen the experience for patrons.

Maker Corps Case Study

PROGRESSIVE ARTS ALLIANCE, CLEVELAND, OH

> **Progressive Arts Alliance Mission Statement:**
> *Progressive Arts Alliance deepens the learning experience for students, educators, and artists by designing and implementing innovative, arts-integrated, project-based learning programs.*
>
> http://www.paalive.org
> http://www.paalive.org/makercorps

Maker Corps Contact: Santina Protopapa, PAA Founder and Executive Director

Maker Corps Member: Diana Bowman

Years in Maker Corps: 2014, 2015, 2016

What's in the mix

- Curiosity about how new tools can supplement rigorous arts integration projects
- Solid administrative structure for supporting Maker Corps members
- Summer programming provides lots of room for project experimentation and iteration

What's ahead

- Growing their school partnerships
- Connecting to more funders in the intersection of arts education and making
- Documenting the impact of their program on students

Maker Education at Progressive Arts Alliance

Progressive Arts Alliance places teaching artists in local K-8 schools to develop arts integrated projects throughout the school year. During the summer they offer summer camps and partner with a public library system to provide programming at various branches for youth ages 11-18 years old. Their artists specialize in all of the arts – from hip-hop to the visual arts, to modern dancers to book-makers. Projects are developed collaboratively with classroom teachers, tied to academic standards and the standards of artistic disciplines, and use any tools that will help the project succeed.

Executive Director Santina Protopapa encountered the ideas of maker education in multiple professional spaces, including Twitter, conferences, and her graduate school network. Her curiosity about how some of the new tools and technologies might support her teaching artists and a desire to know more about how maker education was similar or different to arts integration led her to sign up to be a Maker Corps site in 2014. Santina approached the experience with an open mind, but always keeping a perspective on how the artistic process and products would remain high quality and rigorous.

After three years participating in Maker Corps, there is little distinction of when their artists use "maker" tools and when they don't – the process and perspective have been integrated into how artists approach projects. That said, during their summer programming, when they have dedicated Maker Corps members to test out new materials, projects and document their process, has been an essential time to experiment and learn.

Developing their maker program

Santina viewed joining Maker Corps as an opportunity to push their programming to incorporate different materials and tools with new and established teaching artists, many of whom did not come to PAA with expertise in maker tools and technologies. In addition to their seasons with Maker Corps, PAA has also partnered with a few organizations both locally and nationally to explore partnerships and informal co-learning experiences. Locally they have collaborated often with think[box][1], a makerspace at Case Western Reserve University. Nationally, Santina has taken some of her teaching artists to other organizations in the Boston area, including Project Zero[2] and MIT. PAA has also partnered with the Lifelong Kindergarten group at MIT to co-develop a hip-hop dance coding and animation project in Scratch[3].

But one of her challenges has been to find other arts education organizations who are embracing maker education and finding ways to keep the artmaking rigorous. Progressive Arts Alliance is one of just a handful of arts organizations that have participated in Maker Corps. The field of arts education has tended to view maker education a bit warily. Organizations that have embraced the association have brought in routines from artistic disciplines to strengthen the process of creation. For example, teaching artists facilitate art critiques of student work and process.

Maker Corps at Progressive Arts Alliance

Because using tools like 3D printers, Scratch and Arduinos have now become tools that PAA teaching artists use regularly, Santina views Maker Corps as a great way to get new teaching artists involved. She appreciates the professional development Maker Corps Members receive from Maker Ed and the increased responsibility they have to develop, deliver and document projects. She has also found it to be an effective pipeline for hiring full-time teaching artists; over the past three summers, three of their Maker Corps Members have joined the PAA staff permanently. The Maker Corps Members co-teach with PAA teaching artists. Santina explained that this strategy is intentional: "We have such a mix of teaching artists that being able to have the Maker Corps Members interacting with them helps to see different perspectives to the work. We try to introduce them to all the different things that we do."

[1] http://thinkbox.case.edu/
[2] http://www.agencybydesign.org/
[3] https://scratch.mit.edu/info/codingforall/

Their Maker Corps Member in 2016, Diana, had been a teaching artist assistant during the 2015-16 school year and was encouraged to apply to be a Maker Corps Member.

Diana described PAA's approach to developing and delivering programming as one that values reflection and revision. She documented the lesson plans and activities she developed on the PAA blog (http://www.paalive.org/makercorps/)[4]. It was expected that she would contribute ever week, which wasn't hard. She said, "I never felt or struggled to come up with an idea. It was always something that was already on my mind."

The pedagogy that drives PAA programming draws from artistic practice, with extra emphasis on iteration and challenge and holding kids to high standards. She said, "I [am] expected to always be pushing the kids and not be lax about it. They were always pushing like 'Oh how can we perfect this; how can we make the lessons better.' And so that was a really heavy expectation which I think I got a lot better at too, [which] was learning how to be more engaged in the same activities. After ten weeks they can become a little bit stale but the progression of always how can we make this better made them always engaging."

Diana said that PAA programs are designed to challenge kids to have goals be intentional in their making activities. She explained, "They can struggle getting to those goals and even when get to the goal, we always say, 'Well can you expand upon that?' …It's never something that kids usually think about themselves. They're usually more like what's next, what's next, new activity, what's next, I did this, done, what's next. So we're always trying to emphasize that you can work on the same idea but expand upon it." She reflected that the programs are good at teaching work ethic. When Diana would ask kids if all their challenges or struggles were worth it, she reported that kids would say "Oh yeah!"

A peek inside the program

During the summer of 2016, Maker Corps Members developed and delivered two types of programs: one-hour design challenges at a local community center, and a 2D to 3D Design Camp through the Cuyahoga County Public Library. The design challenge workshops covered activities like using patterns and fractions to create art and using electronics to design wareables. But the majority of their work was spent in the ten camps held through the library system. The camp moved to a different branch every week, and the PAA teaching artists and Diana Bowman, the 2016 Maker Corps Member, could tinker with the curriculum and materials throughout the summer to make sure all youth would be successful.

Join professional artists from Progressive Arts Alliance for this dynamic camp that explores a variety of two-dimensional and three-dimensional art techniques. Experiment with different materials while using your imagination to create original work. Discover how to bring 2-D designs to life through building, digital sculpting, 3-D printing and more.

In the camp, youth worked with many media to explore how shapes are combined to create three dimensional objects. The first few days they used cut paper and platonic solids to rough-out shapes for their inflatable sculptures. Next there was lots of experimentation with fans and balloon-like

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[4] See also: http://www.paalive.org/makercorps/?p=482   http://www.paalive.org/makercorps/?p=514
http://www.paalive.org/makercorps/?p=575   http://www.paalive.org/makercorps/?p=585

plastic sheeting connected with tape that were constructed to make inflatable sculptures. In the final days, the group turned to technology tools, included Tinkercad, 3D printers and 3D glue guns.

Throughout the week, the teaching artists pushed youth to talk about their process and work. On the third day of camp, when pairs of students presented their inflatable sculptures, Frances and Diana led the group in modified artistic critique. "Your comments should be constructive criticism. It has to be helpful to the person, something they can take away as a suggestion," Frances began. "Tell us what base shape you use, your strategy for making your sculpture, what worked and what didn't." As the groups share their process for making the sculptures, the teaching artist add their comments too. "I want to complement you on that scalloped edge on the wings," Frances says. "That's good craftsmanship!" One camper says she would like to figure out how to make her horns stand up. "How do you think you could do that?" Diana asks. As she noodles through some ideas, Diana reminds her of a previous activity that explored building supports for shapes and balancing weight. The girl seems proud of her sculpture, and also has ideas for how to keep going.

A parent waiting to pick up her child whispers to me, "It's really incredible what they've done here!"

Sustaining their maker program past summer

PAA's teaching artists deliver the most programming during the school year in collaboration with K-8 teachers across the city's public schools. They face two challenges transitioning from the summer to the school year. First, the school learning environment is very different from the summer programming in many ways – more students in a classroom, academic expectations, close collaboration with a classroom teacher, and the increased need for classroom management routines. While Maker Corps Members may be able to tinker with projects, tools and materials during the summer classes, they have few opportunities to practice working within the constraints of often-chaotic public schools. Schools also have less expertise with maker tools and materials; as Santina reflected, "They want this kind of stuff but they don't even know how to get there." PAA teaching artists will demonstrate how to use tools and materials to teachers first, while at the same time talking about how to use them with students. They have found that teachers are generally open to learning, which has made the projects more collaborative. While PAA provides embedded professional development in its school-year residencies, they also have provided opportunities for educators and librarians to learn about their pedagogies and materials in various contexts.

Their second challenge is having sufficient ongoing training and exposure to tools, materials and solutions that come from the maker education field. Because they are one of a very few arts education organizations engaged with the maker education community, it has been hard to find a community outside of Maker Corps with which to consistently engage with throughout the year.

Learning from Maker Ed and the Maker Corps Community

Because of Santina's involvement in Maker Corps for the past few years, she feels that she has a good sense of the professional development and resources Maker Corps provides to the Maker Corps Members. While she has stayed involved with Maker Corps, Santina has also delegated some responsibilities for the program to the former Maker Corps Members who have now become full-time PAA teaching artists. In the past year, Santina has found communities outside of Maker Corps to be more valuable for her professional growth. For Diana, learning from what Maker Corps Members were doing around the country was interesting but not essential to her work; like Santina, she found other communities of makers to be more practical.

As for support, inspiration and comradery, Santina values the community of maker education organizations that Maker Ed introduced them to in-person at the SXSWedu conference. As a result of that meet up, she said she found peers that she now communicates with over Twitter and emails. The in-person experience elevated and deepened the connection that had been introduced though Maker Corps Google Hangouts. Santina said she felt like she could explain the work that PAA does to other people who get it – and who can suggest ways to push their practice further, both in tactical and pedagogical terms.

Diana participated in the national Maker Corps network mostly as a learner, reading other people's documentation of their programs and expanding her understanding of terms like tinkering. She found the resources to be easy to read and she could learn much of the new materials quickly. But she found the resources she had access to locally – former Maker Corps Members at PAA, friends at Think[box] and CIA – to be more valuable to her. However, she saw the value of the Maker Corps online community for newer organizations without a strong local community.

Within PAA, Diana found the mentorship from a former Maker Corps Member who was her co-teacher during the summer, to be valuable on many levels. They also looked locally for support when they were trying to figure out how to improve their program, including a local artist and professor at the Cleveland Institute of Art who specializes in inflatable art. Diana explained, "He just gave us all a 'How to do Inflatables 101.' That really inspired us to change how we taught and how we could teach them." Diana described how hearing his feedback on their project prompted them to change not only the tools they were using, but the presentation of the idea and supports, such as a handout of basic shapes.[5]

PAA now has the expertise to mentor and support Maker Corps Members in the ways that maker education integrates with arts education more broadly. Santina wonders if the Maker Corps training and community-building might be more effective as an in-person retreat or workshop with other Maker Corps Members prior to their service, to establish that community from the beginning.

Outreach and Collaboration with Community and other Organizations

The city of Cleveland has a few organizations that do maker education for youth, including the Cleveland Public Library and Great Lakes Science Center (also a Maker Corps site in 2014, 2015, and 2016). While these organizations have had infrequent contact, they are generally focused on different angles of maker education, due to their organization's core missions. As a collaborator or partner, PAA works most closely with think[box] at Case Western Reserve University. The makerspace is open to the public but does not offer youth programs. PAA has brought in youth to work on projects in the space, such as a recent Rube Goldberg machine. PAA staff has also come to think[box] to try out new ideas or materials before they bring them to students. Santina explained, "They have helped change the face of our programming. Our artists were building light boxes with fifth graders this past semester, and just testing it out with a [CWR] Engineering undergrad. Having that opportunity to collaborate with that community has been really great." This partnership allows PAA to explore the possibilities and realities of materials and tools with other makers.

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[5] See Diana's blog about their collaboration: http://www.paalive.org/makercorps/?p=523

During the summer, PAA works most closely with the Cuyahoga County Library[6] system, which doesn't currently have capacity to provide their own programming despite growing interest from patrons and staff. They offer 15-hour summer camp programs free to residents. As a result of their summer 2015 camps that included additional maker materials and tools, the library asked PAA to train their librarians. Santina described that the library told her, "'This is our best summer camp ever! Parents are asking if they can come back to a different library because they loved it so much because they know it won't be the same thing every time.' [This partnership] is pushing our thinking that I think we definitely provided more value to our partners if nothing else. So we ended up training the librarians which was cool as a result of that so I hope they'll put it into use. They were nervous about the tools and everything."

Becky Ranallo, the Information & Technology Literacy Manger for the system, has seen the rise of digital technology in public libraries first-hand over the past 10 years. The system has 27 branches and employs nearly 1,000 staff. They have opened three Innovation centers, which Becky describes as all-ages makerspaces with a focus on entrepreneurship and supporting small businesses (see http://www.cuyahogalibrary.org/Services/Innovation-Centers.aspx for more). The goals for these spaces include making connections between other makerspaces, such as think[box]. She described, "Our focus is on being a bridge to those places, to ensure that our customers get a taste of what they can do and if they need to do something past that, they can move on and explore there. We're also looking at being … a bridge to some of the start-up incubators in the area that are looking for entrepreneurs." One of their strategies is to offer summer programming in half-day camps, such as the one that PAA facilitated. Becky says they fill up quickly. Aside from organized learning opportunities, libraries also offer access to technology and materials with the support and encouragement from staff to figure out the process collaboratively.

As part of this focus on innovation and technology literacy for all library patrons, Becky has pushed for ways to get her staff more experience with maker tools and projects. One of the most effective ways has been to contract with other organizations to provide training, including with PAA teaching artists. Library staff are also paired with the PAA teaching staff in the summer camps, so they gain first-hand experience in delivering programming.

> "[Progressive Arts Alliance is] **wonderful and the programs are fantastic. We love that we can go to Santina with the vaguest of ideas, and she'll be like, 'Yeah, sure, let me talk to my staff.' And then they come up with this amazing program from it. … The other piece we really love from them is they are always willing to offer a program but teach our staff at the same time. And we are always looking for ways to take our staff knowledge that next step forward and get them more comfortable. So they've done professional development for us, but they also welcome as many staff in the program as we want. That's one of the pieces that we really value with them." – Becky, Cuyahoga Library System**

The programs that the library offers with PAA roughly falls into the category of STEAM learning. Becky said she had only one request for PAA as they developed their 2016 camps: kids should create

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[6] http://www.cuyahogalibrary.org/

something with their hands and then create something digitally. Becky explained, "That has been an awesome selling point to parents too because parents who get making, and parents who don't understand right away that I'm showing their kids two sides of the same thing. I use [the 2D to 3D camp] all the time as an example of what we're really trying to do. Technology programming might be our thing, but I'm always looking for that kind of pairing that creating with your hands and creating digital."

The feeling is mutual; Santina and Becky both spoke about the partnership in terms of how they could learn from one another and the different settings they work in. Becky said that when Santina has approached them with a new idea, "We give her where our boundaries might be around that, and they kind of run with it again. I feel that we've helped them develop as well. We're a test case for a lot of programs, but they know us, they know what it's like working in libraries."

Currently, library staff are encouraged to develop and deliver their own technology programming at their branch, supplemented by programs provided through the county system. Becky's expectations are that all staff will have competency working with new technologies, equipment and leading programming for all patrons. She looks carefully across the branches to understand the current staff capacity for and interest in some of the new technologies, and encourages each branch to find ways to explore their community's own interests. One strategy she has used to build momentum and interest in these programs is to share what all the branches are doing with one another. She described, "One of the things we've done is take a map of the system and show everybody who's doing making programs, who's doing coding programs, who's doing technology training. And I make a distinction between these are programs we're running right now and there are staff-led." She said this has helped branches take ownership over developing their own programs and capacity when they see what is possible at other locations and with staff-led support.

As more library staff have become involved in technology and making programs, Becky has realized how important it is to emphasize that they need not become expert in all technologies. She explained, "I see our biggest challenge in the next couple of years, really impressing upon our staff and selling that idea that they are facilitators and not experts. … Our staff who still want to be the expert are struggling with technology in general because you just can't be an expert in everything anymore. It's too much; there is no way to be the expert. And frankly it's not our best role, certainly not with teens and really not with kids. One of our most successful connected learning programs in the last couple months was one at our Garfield branch where our librarian paired up a bunch of volunteers and adults with the kids so the kids could teach them Minecraft. And it was a bunch of adults who wanted to learn Minecraft, and it was a bunch of kids who were excited to teach them." She would like to see more communities of mixed expertise of makers develop at each library.

Becky said she has never perused Maker Corps because of the cost and the hurdles she might have to go through to pay her unionized staff through other means. However, she feels she has definitely been indirectly impacted by Maker Corps. For example, Santina introduced them to someone who was then hired for one of the library's innovation centers. Their collaboration has continued; PAA will offer workshops to make LED Clouds in the winter of 2017 to youth ages 11-18 years-old at various library branches.

Funding Maker Corps and Maker Programs

While PAA has consistently received funding from local and national agencies for their work, Santina has found it challenging to find funding for maker residencies and Maker Corps. She sees this as a

two-part problem: first, that arts education organizations don't know much about maker education and second, that the materials are more expensive for their maker residencies. Additionally, she feels that the local donor base in Cleveland lacks investment in new technologies or materials that has driven the interest in funding maker education programs in other cities. To address this, she has found success in educating donors and educators herself, often demonstrating a project to "build the awareness and see why it's something that's worth providing support for."

Because of these challenges, Santina would like to see Maker Ed help make connections to corporate and national funders that understand their goals and would help them scale up their work and be more sustaining in the long term. She explained, "We know the technical stuff, and we have a lot of infrastructure in our city to get there. … But we're not a super progressive town. Even though we have infrastructure for this stuff, we're not like the [west] coast where there's new money." Furthermore, there is demand for their programming, especially in schools and communities that don't have funding to support the program. She continued, "Right now, if we had a sponsor or a donor, we could have three more of them in the neighborhood that told us we want this, but we can't pay for it. So it's not that the need and the interest isn't there. … [Cleveland] parents are still trying to figure out how to get by. So that's where we're thinking, how do we provide the access to this so these kids can be more successful and go on to post-secondary and all that, you know?"

Building their maker program

Over the past three years, the teaching artists at PAA have increased their understanding of maker materials and technology through participating in Maker Corps and making connections with local makers. At this point, Santina sees PAA's involvement in maker education growing in two ways: to build awareness and understanding for maker education in the arts education field, and to better understand the impact their programs have on students in ways that align with 21st Century Skills.

She feels like she does not have many peers in the arts education field, who question whether projects that have a making or tinkering philosophy produce high quality artwork. She has faced this within national networks of art educators as well as her own staff and board members. She explained, "We have board members, they're like well, it's not even really arts, it's just education and science stuff and it just happened to have art in it. I say, we are an arts education organization with teaching artists; we don't have anybody who went to school for science. This is the way artist think. I think there's a lot of perception and awareness building we can do. … Particularly around how to create interesting art that's not just from a kit. We're trying to do something a little different."

To build support and awareness, Santina would like to be able to demonstrate how their programs influence students' problem solving skills, persistence and if those skills translate between contexts. Arts integration can be a difficult educational approach to measure, but many schools now collect survey data on constructs such as school climate, support and challenge, which have been found to be associated with participating in high quality arts programming. Santina would like to better understand what outcomes are associated with their program, and explore differences among age groups and length of programming.

Maker Corps Case Study

DIGITAL HARBOR FOUNDATION, BALTIMORE, MD

> **Digital Harbor Foundation Mission Statement:**
> *The Digital Harbor Foundation is dedicated to fostering learning, creativity, productivity, and community through education. In 2013 we transformed a closed-down rec center in Baltimore City into a vibrant Tech Center for youth. In 2014 we launched the Center of Excellence to train others how to incorporate making into their own learning environments.*
>
> http://www.digitalharbor.org

Maker Corps Contacts: Steph Grimes, Director of Education and Jonathan Prozzi, Content Developer

Maker Corps Members: Caitlyn Dixon, Elementary Program Coordinator and Mary Reisenweitz, Mid-High Program Coordinator

Years in Maker Corps: 2013, 2014, 2015, 2016

What's in the mix

- Mix of staff expertise in technology, educational pedagogy, visual arts
- On-site support for questions and ideas
- Mutually beneficial partnerships with organizations and educators
- Opportunities for youth to grow their skills over time, become members, demonstrate skill and participate in a youth steering committee

What's ahead

- Growing their outreach to educators state-wide
- Focus on retaining female makers
- Figuring out how to engage with other agencies to support youth in other areas of their life (offering free lunches, working with school districts to offer support)

Maker Education at Digital Harbor Foundation

It has only been four short years since Digital Harbor Foundation (DHF) opened its doors in a converted recreation center in Baltimore's Federal Hill neighborhood, but in that time they have built a reputation both locally and nationally for their maker programs for youth and educators. It has not

been without some bumps in the road – much of their technology was stolen one spring, their founding executive director took a position as the Senior Advisor on Making at the White House[7], staff they hoped would stay moved on – but, true to their maker ethos, they've figured it out. At their core has been an interest in using technology in creative ways and developing long-term relationships to support youth and educators become makers.

For them, the term "making" can be low tech or high tech – and they want to retain that openness and inclusion. Jonathan Prozzi, a Content Developer and Maker Corps supervisor said, "We pull it under that umbrella of, you're making with tech, you're making with code, you know it can be creative, it is creative. I think that that is a big part of it, it's not exclusionary." Steph Grimes, the Director of Education and former Maker Corps supervisor, chimed in, laughing:

"And that there's also this place where we're making with cardboard, right? *[laughs]* That it can be really low tech and it can be really high tech and it all, we can make it all fit. So for us, that has been key to our success. One, so that we don't burn out on either one end of things. If we feel like we've done too much sort of, physical making and really low tech stuff we can jump over the high tech stuff and really like, engage a different part of ourselves as a team, and definitely engage a different audience of our kids, because there are some kids who are super into 3D printing and building things with their hands and wanting to do more sort of physical construction projects. But there are also the kids who are also like, I don't want to do any of that, I want to program and code the day away. So, for us it's really about meeting both of those sets of needs, in the best ways we can. And, knowing that sometimes they need a little bit of both, and so like, we sneak it in."

Their building includes two main classrooms; a smaller one for younger kids (the NanoLab) and a larger space (the MegaLab) divided by a row of bookshelves to accommodate two separate groups at once that also houses most of their technology, tools, and workbenches on wheels so the space can be moved around. The offices are two rooms that accommodate roughly a dozen staff at any one time. Everything is open, set up for collaboration, and full of treasures and inspiration. Over 2015-16 school year DHF served 1,300-1,400 kids and their first group of members, and 20 youth who have gone through their programs have since graduated high school and are attending college or working in technology fields.

Developing their maker program

From the beginning, DHF has looked to Maker Ed for ideas, guidance and leadership. Steph described how she sees them as a sister organization; paralleled in their age and growth. She explained, "It's perfectly aligned with- I mean it's why we do maker education. It's where we learned about maker education, so it's completely aligned with all of that because it's just an extension of what they're doing…The work that we do I feel like is just an extension of what Maker Ed is doing, and what we learned from Maker Ed." In finding their own niche, DHF staff relied on the relationship they were building with Maker Ed through the Maker Corps program to figure out what would work for them. Steph said, "It was like okay look, anything that they're doing I want to be a part of because I feel like I can learn a ton from them. And we as an organization can learn a ton from them, and that's really when it started. So it started as this sort of admiration of what they were doing and the work that they were trying to doing." In the first year of Maker Corps, Steph gathered lots of ideas for projects from the Possibility Box and the Google+ community, many of which they still use.

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[7] http://technical.ly/baltimore/2015/12/28/andrew-coy-senior-advisor-white-house-office-science-technology-policy/

Currently, Digital Harbor Foundation offers year-round maker programming for youth starting in 3rd grade through a set of programs that level students up to become members of DHF. Summer camps last for two weeks and are open to youth between 3rd and 12th grades. The Tech Center also hosts Family Make Nights, field trips for schools, and numerous educator workshops. There are also special programs just for girls (the Makerettes), friendly competitions to design, prototype and develop a product for a client (FabSLAM and WebSLAM), and a 3D assistance program which provides technical support and repairs for 3D printers. In short, there are programs for just about anyone to dive into the type of making they want to do in the environment that feels comfortable to them.

Their approach – offering programs on-site and doing outreach and trainings with educators – attempts to both support youth that already have an interest in making with technology and youth that may not have prior interest or experience to become independent makers. DHF educators see themselves as facilitators, mentors and guides for the youth they work with, which is supported by the longer-term commitment youth make to their programs. Mary Reisenweitz, a Mid/High School Coordinator and 2016 Maker Corps Member, described how she tries to remind students that if something doesn't work out right way, support will be available to keep going: "…Really emphasizing this is *one* version of this … we have lots of time to keep working at this, you can keep getting better at this. Emphasizing that even if it's at the end of the course or whatever, this is not the end of this process." Getting to know youth and families that come to DHF is a core value of the organization. Mary said, "I really *get to know* a lot of these kids. And that is maybe more than anything the most rewarding part of working here."

Maker Corps at Digital Harbor Foundation

Participating in Maker Corps has truly been a learning experience, starting with the first year of learning what happens when things go wrong. "Our first year as a Maker Corps host site was rough because we were all trying to figure out what it meant," Steph explained. The DHF staff member who was supposed to supervise the Maker Corps Members left for a new job before the summer began, leaving Steph to figure things out on the fly. But while things were getting figured out at DHF, Steph was learning about many other models for constructing their program from other Maker Corps sites as they shared what they were doing on Hangouts. In the third year, they scaled their program back (from four Maker Corps Members to two), hired staff they already had relationships with (rather than having an open-call advertised nationally), and didn't run their programs back-to-back.

These changes have helped make Maker Corps a program that supports their organizational mission and gives staff valuable professional learning opportunities. In the past two years they have offered the opportunity to staff they think might be ready to take on more responsibility and grow with in the organization. Maker Corps Members are encouraged to come up with project ideas for summer camps and document them and participate in the Maker Corps community. In the summer of 2016, the DHF Maker Corps Members are two women with arts backgrounds:

Mary is a recent graduate of the Maryland Institute College of Art (MICA), and is the Mid/High School Program Coordinator. She is especially interested in ways that arts and design interface with making. In addition to running summer camps at DHF, she also led some outreach programming that ran into a number of challenges. That experience revealed to her how supported she felt at DHF – by other staff and the youth. She reflected, "There's so many people here. Even the youth who are ready to problem solve and figure it out together, whereas when I was there I sort of realized, whoa, I'm

way more alone than I normally am, and it made me very conscious of the community that's here and how beneficial that as to learning."

Caitlyn is a former PreK-8 art teacher who oversees the Elementary Programs. She loves the mix of materials on hand for kids to explore at DHF, but often thinks about semi-structured ways for them to play. For example, during a "Brain Break" during her camp, she allowed kids to play with Minecraft, but only in creative mode with the motto, "Be constructive, not destructive."

A peek inside the program

On one side of the hallway, nine young kids are working towards creating their very own 3D printed toys. The week has involved working with legos, lots of drawing and learning to use Tinkercad before making their final product. Caitlyn walks the room, looking to see if kids have their hands up or a red flag up on their computer that tells her they need help. She's relentless in her encouragement. One boy asks for help while she's on her way over to another kid. "I'm going to have you struggle until 1:52," she says, pointing to the clock. "I'm going to let you figure this out. I know you can do it." The boy nods and turns back to his computer. Another child interrupts her. "Why don't you ask your friend for help?" Caitlyn suggests. As she settles down next to the child she's been trying to reach, she notices that the child is looking defeated. "I hear a frustrated sigh. Is this harder than you wanted it to be?" The child nods and Caitlyn gives her shoulder a squeeze. She helps the child make the image on the screen longer. "What's your next step? Do you want me to walk you through the next one?"

Meanwhile, on the other side of the hallway in a much larger classroom, there is less need for an instructor's help but just as much engagement and persistence. In the VectorFab course, an older group of kids work independently on building their own maze using the Inkscape software to map the route. Mary is there to support, guide and remind them of what their work is for the day. Projected on the screen Mary has posted the tasks for the day: "Finish assembling cardboard creatures. Finish designing our mazes. If time, finish previous projects." As she moves around the room, the kids try and test their limits. "Does it have to be a maze?" one girl asks with a slight smile. "Yes," Mary responds. "But what did you have in mind?" The girl smiles and shakes her head. The youth have access to templates and instructions in an online forum for the class, so as the students have increased their comfort with the software (this is the beginning of their second week in the camp), they are mostly self-paced. They are all working to have their mazes laser cut by the end of camp.

Sustaining their maker program past summer

Since Digital Harbor operates making programs year-round, summer is a time to test out year-long content and give participating staff that extra investment and responsibility. After the summer of 2015 their Maker Corps Members both took other positions, which had an impact on the organization and their program's momentum. Steph reflected, "We felt this gap and this loss, at the end of the summer, like wow, they were amazing people and we put a lot of stock into them and training and effort and interest in what they were doing and what they were bringing to the table, and it was all phenomenal and high quality and awesome. And then at the end of the summer to just like, lose them, felt- felt like a really big loss." In 2016, Mary and Caitlyn, who were already employed at DHF, were offered the Maker Corps role and have continued to work at DHF.

Learning from Maker Ed and the Maker Corps Community

Steph and Jonathan have continued to participate in Maker Corps because they believe that the professional development for them and their Maker Corps Members, and connections they gain are invaluable.

> "We're a really small staff, and so for us to put together professional developments internally, takes…. there's just so many things that everybody's doing, and so many hats that everybody's wearing that I feel like any opportunity where we can sort of tap into what we know is high quality, and going to do a good job, where then we don't have to fill that gap, like that just makes sense to us." – Steph, Digital Harbor Foundation

Mary was excited to be a part of the online community, and shared things she had learned with the rest of the staff. She also enjoyed the hangouts, especially those she could join live. She noted that the generosity of other sites to share their experiences made her also want to share back with the community. Even when sites aren't similar, Mary felt like she could learn with other members. She said, "There's some common ground and that we're all trying to figure out how to get more kids in our spaces…" However, she has found making meaningful connections online a challenge. Dreaming big, she said, "I think that in an ideal world where everybody has infinite time and resources finding ways to actually be able to visit, like for Maker Corps members to actually be able to visit other Maker Corps sites, would be super, super useful, because I think that that's one of the things I've learned here, maybe more than anything else is learning through experience, and learning on your feet, is so, so crucial." Mary wondered if one way to help foster connections would be through smaller communities of Maker Corps sites centered around a specific issue or challenge. She felt that because each site's context varies, it can be hard to say that something that works in one place will also work in another, but to have the support to discuss strategies to address a shared challenge would be helpful.

Outreach and Collaboration with Community and other Organizations

DHF has become well-known for their approach to technology and maker education locally, within the state of Maryland, and even nationally. Locally, they have made partnerships with multiple school districts, libraries and out of school networks. Nationally, several other Maker Corps sites mentioned them when talking about other places that they looked to for inspiration for project ideas and ways to talk about maker education. The approach to collaboration and outreach at DHF is a combination of selflessly sharing out what works for them, curiosity about what works in other settings, and a real spirit of "we're all in this together." Working with other organizations to extend their reach beyond the Tech Center helps them reach more youth and educators, and informs their programming by learning from other people, places and contexts. As Mary noted, "Everybody here tries to look beyond themselves and often as an organization that means looking to other organizations and trying to find ways to partner with people who are also trying to accomplish things that are bigger than themselves."

While there are a few other technology or maker youth programs in Baltimore, Steph and Jonathan note that there's not much overlap – or collaboration – between those organizations. So while there are opportunities for young people in the region, those organizations don't necessarily communicate to

one another about what their programs are about or look to help youth make connections between opportunities. This is another reason why DHF has reached out to educators and programs in the state. Steph explained how rewarding these collaborations have been, "That has been really beneficial for us, to be able to make those connections, sort of outside the silos, and like, outside the city too, right. … So they're coming from all over the state, we've had some come up from D.C. and Virginia, a couple from Pennsylvania, so, sort of this whole region is coming together and that's been really fun to work together and support them, based on all the things we've learned over the last almost four years." That feeling of fun is shared by their collaborators; below are their perspectives.

The Maker Movement in Baltimore

Tia noted that the maker movement is taking hold in Baltimore, and that many state agencies are working to support one another's efforts. She explained, "Baltimore County is really into the maker movement, in particular highlighting how Baltimore County is a manufacturing and entrepreneurial city. So Baltimore County government, they are pushing a program called Made in Baltimore County. And the library off of that, we're doing a program called BC Makes where we're going to highlight a variety of different, careers topics in making in the county. In particular, we're connecting them with the programs that we offer and kind of on a smaller scale than what the county wants to do. The county is showing the large companies that exist here and the large business that have started here, but we're saying our programs are small businesses, entre-people who came in who are coming into our branches to learn how to 3D print because they have an idea and they created something out of it and then they sold it on Etsy. Or local artists, local artists and musicians and engineers and creators who aren't the big bang business but are smaller but what inspires them to make and create, how they got into this business, what they would tell someone who wanted to get into being an entrepreneur creating things on their own. So, that's a program that we are starting in conjunction with the county, and ours is called BC Makes, Baltimore County Makes. And we're definitely tying in maker programs with that."

https://www.baltimorecountymd.gov/news/baltimorecountynow/made-in-baltimore-county

https://www.youtube.com/playlist?list=PLYAZPzl77odrB8TBCEizC4ZvQ7NvgRoGf

OTHER TECH/MAKER YOUTH SERVING ORGANIZATIONS
Future Makers: http://kidsmakethingsbetter.com/

Code in the Schools: http://www.codeintheschools.org/

DHF hosted Code in the School in the Tech Center as they piloted their program and got started. The organization focuses on computer coding and programming.

Baltimore County Public Libraries, Tia Jennings, Youth Services Coordinator
http://www.bcpl.info/teen

Tia Jennings oversees the youth services programming and staff in the 19 branches of the Baltimore County Public Libraries (BCPL) knows that the role of libraries is changing. "Libraries aren't just books anymore," she said. "And the ability to have a service that anyone can walk in the door and try it out,

and if you don't know about it, we'll sit down with you and work with you and teach you how to use it. Especially because I'm in the youth services department, I think maker programs are great for kids because I always think like the jobs they're going to apply in a couple of years don't even exist." Making and using technology is a part of the BCPL's strategic plan for the next two years

Tia is trying to have making programs available at all of the branches and sending librarians to trainings at DHF has been key to growing their capacity. She knows their trainings to be high-quality, but she also appreciates their willingness to create trainings customized for her staff.

She said, "What I like best is that I'll describe to them what I think our branches are asking for, and they'll create a training around it. Digital Harbor has been great to kind of meet us where we are." This year she sent two librarians from every branch to DHF to receive training in technology and maker programming, with the expectation that those librarians would train others at their branches. Tia was equally impressed at how DHF's staff reached out after the training to check in with all the participants. She shared, "They are really good at following up with everyone who participated in the training and asking them what worked, what didn't work, what they walked away with, what they'd hoped for, how they're implementing any of the information. So they called everyone in that training, and that was like forty people at least." Tia said this made her, and her staff, feel like a part of their network and deepened their collaboration. Tia herself was a little hesitant with the approach at first, but working with DHF gave her the confidence to take it on. She reflected, "I was a little hesitant to try things, but Digital Harbor definitely made it more comfortable. [They told me] its ok it you fail, just try it. That's what the maker, that's what it's about."

For the library system, an organization with a mission of serving all people with free and accessible resources and programming, the maker philosophy in the way DHF advocates for it, was incredibly complementary. Tia continued, "And I love their philosophy of, everyone – oh this isn't good – everyone, this is accessible to everyone. How, they want to make it accessible to everyone. And then saying anyone can do this, babies can do this, older people can do this. Anywhere, any time. And like, you're already making; you're already making things. Are you cooking? You're making. Are you sewing a button on? You're making. So they normalize it. Makers is such a high thing, like you have to be super smart to use this technology. No actually, making can be a lot of different things and we're all makers. Everyone has access to making; what you do with it, how you continue to grow with it is the actual, the bonus. Like when you find that thing that you made and you're like, Oh that felt really good and then you continue and build on it, that's what's fun. That's what I'm looking for." The two organizations have plans in the works to extend their impact by providing maker kits for patrons to check out.

> "I feel like they're just innovative and open and wanting to get the information out, get the technology out of their doors and into someone's hands." – Tia, Baltimore County Public Library

Baltimore County Public Schools, Nick Schiner, Office of Innovative Learning
https://www.bcps.org/digitallearning/LearningProjects/

Nick Schiner coordinates teacher learning and student opportunities in the Office of Innovative Learning for the Baltimore County Public Schools and says that no other organization he has worked with provides the type of maker education professional development like DHF does. The district is relatively new to having maker education be a focus of their efforts, but they have signed on to the Digital Promise and Maker Promise, created a mobile innovation lab with an HP Learning Studio. Nick describes, "We've had pieces and pockets of it [maker education] going on for a really long time. Digital Harbor really has been probably our strongest educational partner in terms of helping us craft what our vision is for it and how we can make it possible and meaningful in all of our classrooms. So I know for a fact that after we left that, we did a two-day training in June with 15 to 20 people from Baltimore County – different schools, different levels – some elementary some secondary, and a number of them reached out afterwards to say how valuable the experience was."

Nick has found working with DHF helpful not only in getting his educators the professional development they need, but also supporting him as a resource teacher and as a maker advocate. He said, "Really where our relationship with Digital Harbor has been helpful is that, while I'm extremely interested in the Maker movement and I had a good baseline knowledge around it, I did not have a full understanding of exactly what that was. I would argue many people in the district didn't. Because it's kind of this ambiguous term, 'maker,' and working with DHF, they clarified is that there really is no clarification. Making is making, it is the process of creating and for producing something, so that was actually really helpful and liberating because I realized that it didn't have to be this really narrow- oh you're doing 3D printing and you're doing textile work, and woodwork and all that- that it can be computer programing, and that it can be graphic design. So, working with them has actually opened up the number of possibilities and also that in turn has really kind of lowered the barrier of entry for all of our schools." As a public school district with varying amounts of resources and expertise, knowing that there are many ways to develop a maker experience for youth – high tech and low tech – is fantastic, Nick said. It's also something he feels like he would not have realized without DHF's guidance.

Nick stressed that DHF is an excellent guide and partner – that they share common goals to get kids excited about making and technology but need to work together on how to figure out how to do that. He noted how whenever he has questions he goes to them first, and when they don't have an answer, "they're willing to go on that journey with you."

> **"Shawn and Steph and Jonathan are incredibly approachable, and they just have such a good understanding of it while also acknowledging that it is a journey for them too and they're growing and they're learning, expanding their knowledge. Just having a partner like that, they're not there to sell you on any one thing. They're just there and their passion bleeds through. And that in turn I think increases buy-in for even those who weren't sold on it or they were sold on it but really just didn't see the implications. That's been hugely beneficial for us." – Nick, Baltimore County Public Schools**

While there's no current requirement that BCPS educators integrate making into their classrooms, it's an approach that Nick hopes gains momentum in the schools because of all the benefits he has observed: genuine collaboration among students, deeper engagement into topics, and more

participation by more students. He believes that by integrating making projects into every unit, including developing a physical project will be a reinforcing experience of the content area. He described observing a classroom of students with behavioral issues work together to program a Sphero to transport an action figure using recycled materials: "The principal said that she had never seen that group of kids engage in work like that and persevere, and fail and not shut down, and iterate, and talk to one another. She said it was one of the most remarkable things she'd ever seen, because those are typically- those kids in that particular class are the ones who shut down when they run into any sort of trouble. [They] try to avoid eye contact and conversation whenever they can and for that hour, you would never know that. You would have *no idea*. So when I see that in the classroom, that's the data I need. When I see that, that's what I need- that really shows they're engaged, they're invested and they're ready to learn."

Maryland Out of School Time Network, Ellie Mitchell, Director

http://mdoutofschooltime.org/

Beyond their own walls, DHF also works with the Maryland Out of School Time Network (MOST) as a provider partner and training for their educators. In recent years, MOST has committed to enhancing their STEM programming by partnering with DHF on two initiatives: creating a STEMbassador Learning Community[8] of 21 educators that received professional development from DHF and developing a digital badging system[9]. They are also partners in the BmoreSTEM ecosystem initiative[10] and Ellie Mitchell, Director of MOST, also serves on the DHF board. All of these collaborations emerged organically as STEM became a bigger focus in formal and informal education in recent years. According to Ellie, DHF has been the organization to show other organizations, funders and policy makers how STEM programs can be successful. She said, DHF "was a model, go-to space in the afterschool school time arena where we could showcase young people, particularly older younger people who were doing really cool stuff."

That "really cool stuff" was supported by excellent educators, educational pedagogy and youth programming features. Ellie is an advocate for program evaluation, both to improve programming and document impact. As such, she uses the Youth Program Quality Assessment[11] and the Dimensions of Success observation tool[12] with her programs and the STEMbassadors. Early on in their partnership, she connected with DHF staff about their shared investment in program evaluation and interest in reframing conversations about what can be achieved by out of school time programs and demonstrate that to funders. She added that DHF has been able to demonstrate that youth are developing skills and confidence which is a precursor to helping them in college and careers – an important message for funders to hear. "Digital Harbor is kind of a place where you can go and whatever you can kind of think of, it becomes a possibility." Ellie concluded. "And this is I think, unique."

Building their maker program

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[8] http://mdoutofschooltime.org/initiatives/stem/stembassador_learning_community
[9] http://www.digitalharbor.org/badges/
[10] http://bmorestem.net/
[11] http://mdoutofschooltime.org/initiatives/youth_program_quality_assessment
[12] http://www.pearweb.org/tools/dos.html

Despite its young life, DHF has accomplished an incredible amount in four years. "Their trajectory was a slingshot," Ellie said. "And I think that now the growth is going to be slower." Steph and Jonathan agree. They feel that currently they serve about as many youth as they comfortably can in their space, but they are working to increase their work with educators, as maker education has become part of the educational landscape in Baltimore. Steph said, "I can remember the first year with Maker Corps and sort of coming in and being like, 'Wow! These places in California, like, they know their stuff, they've been doing it for a long time, they've already figured out so much.' And now it's starting to be like, we sort of rode their coat tails for a little while and learned what we could from them, and now it's here, it has arrived in Baltimore. Some of the local school districts are signing the Digital Promise, and signing the Maker Promise, and they're saying like, 'You're gonna have Makerspaces in your libraries and every school. So what does that start to look like?' We're really grateful and excited to be a part of some of those conversations, and be working with the educators."

One of their strategies to extend this work was to establish the role of a Maker Teacher Fellow, and invite Scott Dellosso a Middle School Language Arts Teacher at Perryville Middle School to figure out what that role could be. Scott met Shawn and Steph at a Maryland educator conference where they demonstrated some technology. Scott is a team leader for Destination Imagination (DI)[13], an organization that hosts annual challenges for groups to creatively problem solve. He was curious about how a 3D printer might help his team. "From the start they were incredible. They were like, 'Us! We will help you! You don't have to go anywhere else.' And so, the first thing we did is, they actually came to my school," Scott said. "From there, the relationship just sort of started to grow. Two of the kids from that original DI team, who are now juniors in college are going to be working for DHF over the school year. I've continued to have a great relationship with them. I'll be like, 'Okay we want to learn about Arduino stuff, let me bring a group in.' They'll be like, 'Hey, we want to know how such and such will work in the classroom, like, can you try this out?'" Their relationship is reciprocal – he tries things out for them in his classroom and they provide him with ideas and support.

Scott's inclusion of maker education approaches in his classroom and DI teams has been well-received but he still feels a little like a pioneer. "The response is phenomenal," he said. "I mean, everybody loves, what I'm doing, I just don't know how… there's just no initiatives that are coming down, like, that are really enforcing this. … I feel like it's coming, but I feel like it's taking longer than it should." This year, Scott's principal has given him a second classroom to open a Makerspace, which he will lead and work with other teachers. His DI teams have grown so large that other teachers now lead three different groups, and Scott will act as coordinator for all the teams. The Makerspace will start as a drop-in program for students and then incorporate badging. Eventually he wants to offer teacher badging. He said, "So that's how I'm gonna get it *in* the school program. I'm gonna start with afterschool thing, get our feet on the ground, get teachers trained."

As part of his Fellowship with DHF, Scott has been contributing his thoughts about the similarities and differences between informal and formal maker programs on DHF's site for educators, https://blueprint.digitalharbor.org/. Over the summer he posted his Maker project rubric, which he had tested out with his own students and some of DHF's summer students (https://blueprint.digitalharbor.org/articles/maker-project-rubric/).

This new avenue highlights DHF's approach to solving challenges. Namely, partnering with other people and organizations to figure out tough problems together, documenting their strategies and

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[13] https://www.destinationimagination.org/

projects, and always applying a high level of rigor to their efforts. They are committed to improving their programs and practice to be more inclusive, especially for girls and youth with diverse abilities. Steph and Jonathan spoke about creating an all-girl cohort of their Maker Foundations program as well as the Makerettes[14] group, a special tech club for girls in their programs that meets to complete special projects and explore new technologies. DHF has also worked with the Baltimore OST/Inclusion Project[15] organized by Disability Rights Maryland to become an OST Inclusion Site. They have received training on inclusive practices and have worked to identify inclusion goals for their programs.

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[14] http://www.digitalharbor.org/whatwedo/projects/makerettes/
[15] https://inclusiveostbaltimore.wordpress.com/197-2/

Maker Corps Case Studies
UPDATE ON 2014 SITES

Introduction

In 2014 we profiled three Maker Corps sites that represented different settings, audiences and regions around the country, to better understand how Maker Corps helps organizations achieve their goals for maker education. Now, two years later, these organizations continue to explore how making education can help them achieve their institutional and programmatic goals.

All three organizations agreed that participating in Maker Corps helped them to gain skills in effective facilitation, gather ideas for projects, and connect with other maker educators. While they felt they had more or less graduated from the program, they emphasized the program's value for organizations newer to making or without a strong local community of other maker educators.

REM Learning Center, Miami, FL

http://www.remlearningcenter.com/
Play Make Share program: http://www.remlearningcenter.com/playmakeshare/
Dr. Ryan Moreno, STEM Educator and Dr. Jacqueline Moreno, Administrator/ Developmental Psychologist
Years in Maker Corps: 2013, 2014, 2015

REM Learning Center participated in Maker Corps for three years, in that time giving the opportunity to their teachers as a time to deepen their practice and experiment with new tools and technologies in the Play Make Share room. Ryan reflected, "The majority of what we were able to get out of it is catalyzing this whole idea of making, and showing others examples. Since it's not so widespread, at least in our neck of the woods, it's not like we had a community that we could reach out to and meet. This allowed us to have on a national stage, some other community leaders that we could use as examples and speak to."

Currently, their 2014 Maker Corps Member, Barbara, is the lead Kindergarten/1st Grade teacher. She has been able to consistently bring making projects to her students both in the classroom and the studio, as well as be a strong mentor for other teachers. During the school year, children visit the Play Make Share studio twice a week for an hour (in the summer, they can increase that to three times a week). One change in their practice since 2014 has been to be more intentional about supporting children to plan out their creations. Jacqueline explained, "They're drawing their mental plan in their head and they're trying to put it on paper from the beginning and then they continue that process every single time until the end of the year, you can see that they have these elaborate, wonderful drawings that really capture it better." This fits with their focus on helping children develop their critical and creative thinking skills.

While REM has grown its capacity to support maker education, the city of Miami still has limited opportunities for youth. Ryan and Jacqueline also spoke about the small number of early childhood educators who have invested in maker education, and continue to look for ways to build that community nationally.

Science Museum of Minnesota, St. Paul, MN

https://www.smm.org/play
Play. Tinker. Make. program: http://shimmrglittr.tumblr.com/
Keith Braafladt, Director of Learning Technologies
Years in Maker Corps: 2013, 2014, 2015

Maker education is embedded in many programs at the Science Museum of Minnesota, but most acutely in the Play. Tinker. Make. program that activates the museum floor every Saturday afternoon.

> **The PTM program is centered on engagement. PTM activities are facilitated experiences that are fun, experimental and create opportunities for open-ended creative exploration. While all activities have a basis in science, *the foundation of the interaction between the visitor and PTM volunteers is the _experience_, not the science.***

Maker Corps was an important program for SMM to participate in because of the national recognition of the type of education Keith has spent most of his career advocating for. It also gave him an opportunity to focus on developing a strong program model for supporting the learning that Maker Corps members do. Keith explained, "Our model was you had practical objectives, you had to work in this program that we had and that was R&D [research and development] work. You just had to do it, you had to be present and you had to do that. You had to develop new ideas for the project. There was no pressure to either succeed or fail in those but we'll work on them and we already know within our R&D group here how to coach and support and help ideas more forward. We know how to be critical and that was stuff that we shared with the makers, so they were learning a lot in finding and developing ideas. And I helped form the directions that they took." As part of that model, Keith gave the Maker Corps Members funds to develop an independent project, which gave them practical experience with managing a project budget, sourcing materials, prototyping an activity, and documenting the final iteration.

Keith and his team has continued to prioritize documentation of their activities and facilitation strategies. They regularly post on sites such as Snapguide[16] and Vimeo[17] and are active in the ASTC Community of Practice on Making and Tinkering[18]. They have started to work more intentionally with their volunteers to identify learning goals for their activities, learning goals for themselves as facilitators, and select language that feels appropriate for the activity (Keith tends to use the words *create* and *tinker* more than making). Keith plans to participate in Maker Corps in 2017, thanks in part to a donation to the Learning Technologies Center that will help him cover the costs of participating. Keith is proud to say the museum has hired almost all of their former Maker Corps Members on as staff. He continues to work on finding opportunities at the museum for people who are interested in facilitating playful learning experiences, and to find a career path within the museum.

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[16]https://snapguide.com/learning-technologies/
[17] https://vimeo.com/learningtech
[18] http://www.astc.org/professional-development/communities-of-practice/current-communities-of-practice/

Millvale Community Library, Millvale, PA

http://millvalelibrary.org/
Millvale Makers program: https://www.instagram.com/millvalemakers/
Nora Peters, Maker Program Director
Years in Maker Corps: 2014, 2015, 2016

In the summer of 2014, the Millvale Community Library had just opened its doors. In the past two years the library has grown in many ways. Maker education has remained a big focus for the library, and recently Nora Peters, one of the 2014 Maker Corps Members, became the library's first Maker Program Director. After her Maker Corps summer, Nora stayed in Pittsburgh working various jobs and returned as the only Maker Corps Member at the library in 2015. During the 2015-16 school year, Nora continued to work on maker programming for one day a week, and then in summer 2016, funding was secured to create a full-time position for her as the Maker Program Director.

Nora was pleased with the programming that she was able to create and offer this summer at the library. She explained, "This summer was a step in the direction towards more in-depth programming. We had smaller groups, we had more focused themes, and we had them register, which was huge, so we knew exactly who was coming every day, for the most part. …So that allowed me to do more specific planning, we went on field trips that related directly to the projects we were working on, I brought in people in the community to talk to them about how this translates into this job, how this translates into college, how this translates into the future. And that seemed to go over really well."

Nora appreciates the community of other maker educators that Maker Ed facilitates and the resources she had access to as a Maker Corps Members, such as the online hangouts and project ideas. She has especially appreciated meeting other educators in person. The greater Pittsburgh area has several organizations that have participated in Maker Corps and Nora has used that community as a resource for thinking through their programming model.

Securing sustained funding for the library and its programs has been a slow process, but Nora is hopeful that the establishment of her position will lead to more programming, visibility and opportunities. She explained, "… Program sustainability is really difficult, especially in a program, or an organization as small as we are. I don't plan on leaving the library any time soon. I couldn't say that my first summer, I really didn't know what I was going to be doing, but I feel like I've found a little niche of Pittsburgh here that I really connect with. I think that thinking about sustainability, not only in numbers of kids reached or interest of the community, but also just in every way, really. I think the fear with a lot of library programming is that it's not gonna stick." She is considering applying for the Maker VISTA program as a strategy for growing their capacity.