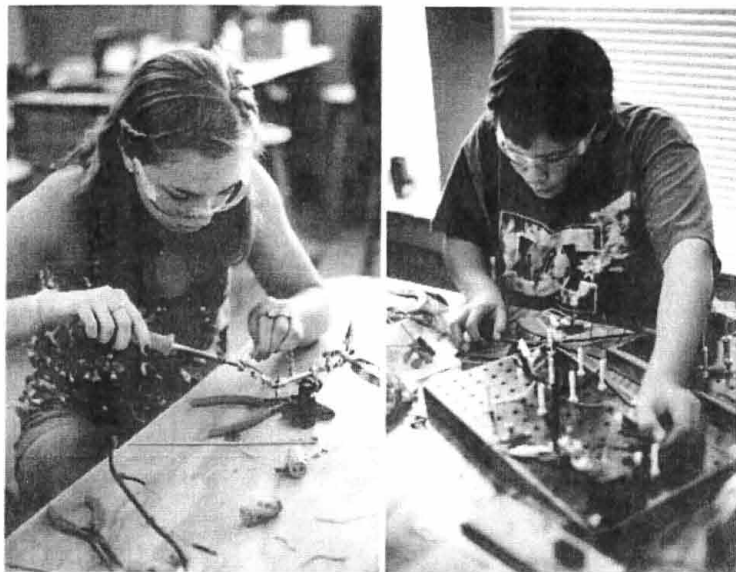


Makerspaces in Education and DARPA



Dale Dougherty | Wednesday April 4th, 2012 2:00 PM

Reprinted with permission from
<http://blog.makezine.com/2012/04/04/makerspaces-in-education-and-darpa/>

Recently, Mitch Altman announced publicly that he's not participating in Maker Faire this year because MAKE received a DARPA award for education. I have talked to Mitch and shared in detail our proposed work. I have listened to him express his concerns about the DARPA award. I don't agree with Mitch, but I respect his opinion. I believe that Mitch's public statements do not fairly characterize the program and have caused confusion about DARPA's role. I'd like to explain what we're doing and why.

In 2011, Saul Griffith and I, representing Otherlab and O'Reilly Media's MAKE division, respectively, learned that DARPA selected

our MENTOR proposal to bring the practices of making into education and extend the maker movement into schools. The new tools and methods of collaboration that are shared within the maker community need to be brought to schools, and it was going to take a major effort to make this happen. Our program would encourage schools to engage more kids in making by creating makerspaces and providing access to these tools for student projects, and use Maker Faire to showcase more work from students. We announced the program early in 2012 on makerspace.com.

The DARPA award challenges us to establish the practices of making in high schools, reaching 1000 schools over four years. (Those schools need not be limited to the United States.) By creating makerspaces in an educational context, students can have access to tools and equipment that they might not have otherwise; they can collaborate on projects that are driven by their own interests, and by doing so, develop the capacity and confidence to innovate. We see making as a gateway to deeper engagement in science and engineering but also art and design.

Here are the major areas of work we have under development as part of the Makerspace program:

1. Work with engineering and science educators to develop teacher's guides for MAKE projects that will help educators integrate making into their own curriculum. All materials that we develop under the program will be made available for free under a Creative Commons license.
2. Develop modular specifications for low-cost makerspaces in educational settings. We want to encourage schools to establish makerspaces, so we are providing some basic guidelines on the costs of getting started. You can find a draft of these specifications on makerspace.com.
3. Write an overall guide to teaching the practices of making for educators, mentors, and others who help coach students to become makers. This is similar to the guide we've written for the Young Makers program. (see youngmakers.org)

4. Build a collaborative online platform that can be used by teachers and students to select projects, monitor progress, and generate student documentation for the work. This platform will allow students to work beyond their own classroom with other students and mentors.
5. Integrate new design tools for CAD and CAM that help students become familiar with 3D design and personal fabrication.
6. Prototype a low-cost, open-source CNC machine that can be affordable for schools to use.
7. Over three years, build a network of up to 1000 participating high schools.
8. Showcase the work of students at Maker Faires and bring students together to meet each other and other makers in the community.

All the software we develop as part of the program will be made open source. All material developed for the program will be made available online under Creative Commons. Neither DARPA nor O'Reilly is placing any claim on student work.

Saul Griffith of Otherlab, our partner in Makerspace, wrote the following summary:

The Makerspace program aims to build literacy in design, science, technology, engineering, art, and mathematics, by combining what O'Reilly Media, MAKE magazine, and Otherlab have learned about the maker community. We wish to do this with as much engagement as possible with the broader maker community to leverage the fantastic energy and talents of everyone doing beautiful things.

Our emphasis will be threefold:

- 1) Self-directed learning (building your own project as a better motivator to engage in engineering).
- 2) Lower the cost of building and realizing dream projects through lower cost tools (software and hardware.)
- 3) Making making more social and engaging.

Creating models for makerspaces at schools is the heart of our approach. In some of our pilot work, we are seeing that having a place to make things creates new opportunities. We are re-thinking the shop class and re-inventing the computer lab, and combining both of them. The makerspace should be like a library, available for use by anyone in the school to make things for a variety of purposes.

Insight into DARPA

We were motivated to apply for the DARPA grant by the following statement that was part of the MENTOR program: "One of the biggest challenges we face as a nation is the decline in our ability to make things," Dr. Regina Dugan, then Director of DARPA. The MENTOR (Manufacturing Experimentation and Outreach) program, we believe, gives us a framework to develop educational materials for high schools and to promote the practice of making inside of school.

I can't speak for DARPA, but if you want more insight into their rationale for funding, you can find a talk by former Director, Dr. Regina Dugan, on this page:

<http://web.mit.edu/newsoffice/2011/darpa-manufacturing-event-1214.html>

This video also points out that DARPA has relationships with lots of organizations including many top universities. The article opens with: "The connection between MIT and the Defense Advanced Research Projects Agency (DARPA) over the decades has been a strong one." MIT has been known to produce more than a few hackers. MIT also produces engineers who work in a variety of fields, including the military. This is true of every university that trains scientists and engineers in the US.

Clarifications

I have been following the conversations on Facebook, Slashdot, and Twitter. I am troubled by speculations that others might accept on face value.

- All software we develop under the DARPA program will be available as open source. That's a DARPA requirement and

we're glad that they have it. This also applies to content and other materials that we develop for the program.

- Student work is not owned by DARPA. Any assertion that DARPA is providing funding to access student work or its intellectual property is just not true. DARPA does not have any claim on student work. Our program encourages students to "make" and share. It is up to the students and educators what to build. We are building infrastructure for project sharing, which we believe engages more students in the process of making.
- We had the military participate at Maker Faire in Detroit, representing TARDEC, one of the area's largest employers. (RDECOM, the Army's research and development group, employs something like 30,000 civilian scientists and engineers worldwide.) We published a story, Code 72, on the makers who work at the Detroit facility.
- We've engaged with NASA, the Department of Education, the National Science Foundation, and other federal agencies. More importantly, we've supported others in education who are seeking funding from these agencies to develop programs or research about making. If you want to work in education, you need to work in the government.
- We are one of several groups to receive funding under the MENTOR program. Our funding is up for review and renewal each year. DARPA has been a good partner that understands the long-term benefits of this kind of work.
- DARPA funding is only part of the picture of what we are doing in education. I am working to set up a non-profit that will raise funds for promoting making in lots of community contexts, both in school and out. Already, we have almost a year's experience with a program such as Project Make at a local high school. We are in the third year of the Young Maker's program, which supports kids building projects to bring to Maker Faire.

MAKE magazine and Maker Faire have helped establish a worldwide community of good will. This maker community has created amazing new opportunities for lots of people to develop their potential as creators, builders, and innovators. I'm proud of that, but I'm also disturbed by who is not in that community. I believe that one of the

reasons for such inequity is our education system, which is broken in so many ways. My work in education is predicated on the idea that exposing more kids to making will create more makers and those kids will have better lives as a result. We can reach more young people through our school system than we can otherwise. I also believe that we have teachers in education who already value making and are already introducing the practices of making. I've heard from many of them and I know they need our support. They want to work together with the maker community to bring about change in education. I know it's a difficult challenge, but I am personally dedicated to making it happen.

By helping young people develop the ability to make new things and inviting them to become makers, we connect them to a global community of experts and amateurs. I hope many of them will choose to be scientists and engineers but I hope that they do so because they have discovered that this is what they love doing. I hope that they come to understand how to use these abilities to tackle important problems and find creative solutions that benefits all of us. The goals of Make and DARPA align in this instance because we have a mutual interest in seeing a more diverse pool of young people become scientists, engineers, programmers.

For me, the DARPA funding signifies that a revitalized manufacturing capacity is a national priority, and fostering interest among young people in making things is how we can take concrete steps to address that issue. Makerspace is not a DARPA program; it is a program that DARPA helped with their funding, which ultimately comes from the US taxpayer. Our Makerspace program is designed to learn from what we see happening in the maker community and work closely with the intersection of the communities of makers and educators to spread these ideas, technologies, and innovation more broadly across our country and the world.