With new printers, classrooms will go 3-D

By Christina Hernandez | Jun 1, 2010 | 0 Comments

A 3-D printer might be coming to your local elementary school. A consortium of colleges and universities, professional organizations and corporations want to bring at-home printing to the next level. They’re starting with a pilot program, Fab@School, that would add 3-D fabricators to public school classrooms with funding from a MacArthur Foundation Reimagining Learning grant.

The pilot project provides an introduction of fabrication technology, moving from 2-D printers that yield items to be folded into 3-D objects to 3-D fabricators that create 3-D physical objects. Five Virginia schools and one school in Hawaii are currently participating in the pilot, with planned expansions to include schools collaborating with Hofstra University in New York and the University of North Texas. Other pilot sites are being established in Indonesia, Egypt, Japan and China.

The project’s partners include the National Council of Teachers of Mathematics and Canon. Two of its main collaborators, Hod Lipson, associate professor of computing and information science at Cornell University, and Glen Bull of the Curry School of Education at the University of Virginia, recently answered my questions about the project.

How do 3-D printers work?

Lipson: The 3-D printer is a machine that makes physical objects on your desktop. For example, if you have an ink-jet printer, it makes an image by spitting out droplets of ink onto a piece of paper. Imagine an ink-jet printer that instead of droplets of ink spits out droplets of plastic. It basically creates a thin sheet of plastic. It then goes up a tenth of a millimeter and prints out another sheet of plastic. And gradually over a period of an hour or a couple of hours, it will form a three-dimensional object. Literally, it’s something you can pick up out of the printer, for example, a cup you could go drink some water with.

Who uses 3-D printers now and do you expect they’ll become more mainstream?

Lipson: This technology is not new. It’s been around for two or three decades already. It’s been very, very expensive and it’s very limited in its ability. They’re big and expensive and used primarily by big firms. It’s very much like the mainframe in the ’60s and ’70s where the big companies knew how to make these computers, but couldn’t foresee what it would be useful for.
at home. Part of that is just a vicious cycle of large and very expensive machines that can only be afforded by big companies and therefore have no market and therefore will remain expensive. It's a wonderful technology. It's amazing to see this physical object appear on your desktop that you can then use. I think it's implications to society are as profound as computers. The transition from mainframes to personal computers could be similar to the transition from these big fabricators to personal fabricators. It just opens the door to personal fabrication.

Why do you want to bring these 3-D printers to the classroom?

Lipson: When you look at what made computers transition into the homes, one of the things that historians identify as a turning point was the availability of kits that people could make, low-cost computers. Those machines became accessible. That's what we set out to do. We do research on printers that can print with multiple materials. We also built an open-source kit that will allow people to build these at home for a very low cost, about $1,000. That's something we did awhile ago. It's called Fab@Home. That became very popular and people did all kinds of things with the machines, but it stayed in the realm of the hobby community. We were thinking about how we could get into schools because it's a wonderful tool to get children to access. When I showed it at my son's elementary school, the kids really got excited. I think it was the first time they'd ever seen something manufactured. We printed a space shuttle out of two Play-Doh colors. They were just blown away. Kids might not learn in the abstract, but they understand it when it's connected to something they really want to do.

How will the students use the 3-D printers in the classroom?

Bull: Producing and creating customizable manipulatives like base 10 rods, fraction cubes, geometric Tangram shapes all potentially support elementary students' mathematic proficiency and understanding in ways that the teacher controls. Opportunities to design and construct the parts of simple machines in an iterative, scientific inquiry process promote student creativity and hands-on exploration. In social studies, students can recreate replica scale models of the Pyramids of Giza as they conduct research about the mathematics and historical nature of these ancient wonders. Language arts experiences are enhanced when teachers use the Fab@School 3-D printer to make characters and objects in books that students use for story re-tellings, sequencing activities and comprehension assessments.

How will you determine whether the program should continue past the pilot stage?

Bull: The decision regarding participation by corporate partners will depend on the commercial outcomes. The decision regarding participation by academic partners will depend on whether the evidence indicates that this is a promising direction that can result in increased pupil learning.

What are the challenges of bringing 3-D printers into schools?

Bull: While the technology is in emergent state and there are certainly a number of technical challenges, we anticipate that these will be resolved over a period of time. The more significant challenge is pedagogical. Effective use of digital fabrication in schools will require seamless integration with the existing curriculum. Curricular constraints preclude addition of new content in the elementary grades. Addition of new content is not necessary to promote the engineering
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design process given its interrelatedness to science, mathematics and technology. Thus, the incorporation of engineering concepts utilizing digital fabrication can be connected to existing mathematics and science standards. In this context, children's engineering in the elementary grades can be described as design under constraint, optimizing to a goal, with verifiable tasks that allow children to build a solution to an engineering problem. This offers opportunities for contextualized mathematics and science.

Watch the YouTube video to learn more about the project.

Image, top: Hod Lipson, with Jeffrey Lipton (in black) and Jim Smith (blue), assemble the Fab@Home printer / Courtesy of Cornell University

Image, bottom: Glen Bull

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