

DIY and save: A scientist's guide to making your own lab equipment

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Scientists can furnish research and education labs for a small fraction of the cost by printing their own equipment, says Michigan Tech's Joshua Pearce, who explains how in his new book, "Open-Source Lab." Credit: Joshua Pearce/Elsevier

Joshua Pearce is not one for understatement. "This is the beginning of a true revolution in the sciences," says the author of "Open-Source Lab." For cash-strapped researchers, he could be right.

His new book, published by Elsevier, is a step-by-step DIY guide for making [lab](#) equipment. The essential tools are a 3D printer, open-source software and free digital designs. "It's a guidebook for new faculty members setting up labs," he said. "With it, they can cut the cost by a factor of 10, or even 100 for research-grade equipment. Even in

the classroom, we can do a \$15,000 educational lab for \$500."

In keeping with the open-source concept, parts of "Open-Source Lab: How to Build Your Own Hardware and Reduce Research Costs," will be freely available at different times on the Elsevier Store. Chapters one and two are free now.

Pearce, an associate professor at Michigan Technological University, began printing out lab equipment in earnest after a seminal moment, when he priced a lab jack at \$1,000. "All it does is move things up and down," he said. Using a printer and open-source software, his team made a utilitarian replica for about five dollars.

Pearce hasn't looked back. On his desk is a dual-purpose gadget: it can measure water turbidity, like a nephelometer; and it can do chemical analysis based on color, like a colorimeter. "We've shoved two devices into one, and it's completely customizable," said Pearce. To buy them both with equivalent accuracy would have cost over \$4,000. To make this hybrid on a 3D printer cost about \$50 including the cost of an open-source microcontroller, sensors and LEDs.



After Joshua Pearce priced a lab jack at about \$1,000, he decided to make his own using a 3D printer and open-source software. The resulting piece of equipment cost him about five dollars. Credit: Joshua Pearce

Saving money is just the half of it. "This lets faculty have total control over their laboratory," he said. Because designs are fluid, "devices can evolve with your lab rather than become obsolete."

The technology goes beyond slashing costs; it can also result in better science, says Pearce. Replicating another researcher's work becomes much easier and cheaper. "Equipment designs can be shared as easily as recipes," he said. "Scientists from all over the world are contributing designs." And it may change the dynamic of graduate education. "We get a huge influx of students from China, India and Africa, in part because they have so few good labs," Pearce said. "If they could print their own equipment, they wouldn't have to leave their home to study unless they wanted to, and many more talented people could contribute to experimental science. We could have a truly global scientific community."

But for Pearce, perhaps the best thing about open-source 3D printing is the open-source part. Makers, as 3D printer aficionados are called, not only use designs posted on the Internet. They also post their own and provide feedback. "It creates positive scientific karma," he said. "You can share your ideas and get help from the community, and it speeds things up so much. It's like having a global R&D team dedicated to your work ."

"Open-Source Lab" is written for a wide audience, from novices to those who are "at one with the force of open source," who can skip the introductory material and get right to work printing their own equipment.

At the close of the Acknowledgements section, Pearce cautions the reader not to rely too heavily on existing designs. The whole point of open-source printing is to join the community and share, share, share. "If the hardware is not good enough

for you or your lab, remember, it is free, so quit whining and make it better!"

More information: To access "Open-Source Lab" at the Elsevier Store, go to http://store.elsevier.com/coArticle.jsp?pageid=18200010&utm_source=Joshua+Pearce&utm_medium=marketing&utm_campaign=Open-Source+Lab+Free+Access

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