Should You Buy a 3D Printer?

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It's March, and I'm in the midst of planning a large summer road tour to bring professional development about maker mindset, maker culture, and makerspaces to rural and underserved communities throughout Michigan.

As I talk with librarians in communities throughout the state, the topic inevitably turns to 3D printing. What role, if any, should 3D printing play in their libraries and communities? Are 3D printers a symbol of progressive librarianship, so libraries should have them to position themselves as *au courant,* sacrificing other purchases to get one? Or a sign of a responsiveness to local needs? The answer isn't always clear.

A week later, I am at the SXSWedu conference on a panel discussing a National Maker Plan. My portion of the panel is a discussion of the importance of knowing one's community's needs, then using that information to inform a purpose statement, charter, or manifest for one's makerspace. As an example, I quote one of the librarians to whom I have spoken. In her small rural town, there is a DIY group that teaches anything from how to make fishing flies to how to taxidermy a fish. Then I wonder aloud: in a community where fish taxidermy is valued, is a 3D printer necessary?

Someone responds on Twitter that a better answer would be to make a 3D *scan* of the fish, a file that could later be used to 3D print fish, compare them in size, and measure them. Then it hits me: the whole reason fish get preserved and mounted is because they are a souvenir of a great day of fishing. They are talismans that signal a fisherwoman's success (after all, they don't call them "fish stories" for nothing!). It's seeing the *actual fish* that validates and authenticates the experience. A 3D replica onscreen or printed in plastic is an abstraction, a step back from the authentic experience.

In other words, scanning the fish *sounds* cool but actually adds little intellectual or emotional value. This example raises critical questions for me, reminding me of how tangled up our thinking is about 3D printers in libraries. To put it bluntly, do libraries *need* 3D printers or just *want* them? In acquiring these near-magical tools, are we solving an authentic problem? Or are we trying to show how cutting edge we are by buying a novel device? What are libraries' 3D printers *for,* and do you need one?

3D printers have a natural place in engineering or shop courses, where students can develop skills in 3D modeling over time, with extensive guided practice. Additionally, 3D printers can help art and jewelry makers explore their craft in new ways. For example, jewelry makers, once confined to costly metals, can now experiment with using resin to create either one-of-a-kind designs or easily replicated multiples.

Does *your* library need a 3D printer? Try using these questions to help you decide.

What is your vision for your maker program? If your program's goal is to develop entrepreneurial skills, then a 3D printer can be a great way to produce custom objects that students can prototype, market, and sell. If, instead, your goal is to have a drop-in space between classes, then a 3D printer probably doesn't print quickly enough to meet that timeline, and hand manipulatives (e.g., LEGO, littleBits, or Snap Circuits) might be a better fit.

Why do you want a 3D printer? If your answer is something like, "Because So-and-so has one," or, "Because I'm scared my job is going to be on the line if I don't keep up with the latest tools," think again. If, instead, you recognize that there is an aesthetic, curricular, entrepreneurial, or constructivist purpose, then this might be a good tool for you. If you cannot articulate an instructional purpose in an elevator speech, hold off.

Is the library the best place for the 3D printer? If an art, engineering, or shop program has regular, ongoing need for the 3D printer, it may be most efficient to place 3D printers in the corresponding classrooms, not with you.

Do you have the budget to purchase one? 3D printers have come down significantly in price in the past 24 months. You can now buy a MakerBot for under $1000 or a highly-rated LulzBot Mini for $1250. Programs like DonorsChoose.

org, Patronicity.com, bake sales, and PTA donations can often make the initial purpose possible. Securing funding for purchase may be one of the easier steps.

Do you have the budget to purchase filament both now and in the future? Filament is the industry term for the spools of plastic that feed through the printer and, once melted and extruded into threads, "draws" each layer of a 3D print. As the number of filament manufacturers goes up, a resulting price decline has occurred. Be sure to price out the cost of replacement spools when you are comparing printer models (know if the printers you are considering require ABS or PLA filament – most printers take only one of the two kinds). Some libraries offset the cost of filament by charging a token amount per minute or size of print, but for school libraries charged with serving all students, this option may not be open to you.

Do you or someone on your team have the time to run the machine? In a real-world makerspace, individuals would schedule time on the 3D printer and monitor it while it works. In a school setting, students may have to dash off to another class or activity. Do you or a member of your staff have time to queue, monitor, and quality-check 3D prints during class? Who is in charge of this step?

Can the printer accommodate the number of print jobs it would take for an entire class to print something? While the print speed of 3D printers has accelerated greatly in recent years, most consumer-grade printers were designed for individual, not group, use. Imagine that a Consumer Education course assigns all 60 students (30 in each of two sections) to create and print a smartphone case. At a conservative estimation of 45 minutes each, it would take 45 hours – more than a week's worth of school – to print out everyone's project. Is that doable?

Do you or someone on your team have the expertise to run the machine? Do you know rafts from supports and slices? Rafts are removable, 3D printed "floors" underneath your print that can help tall and narrow objects stay upright and immobile. They are removed after the print job is complete. Supports are temporary scaffolds – akin to stalagmites – that provide support for cantilevered areas of the object. You might need supports if you are printing a dog because the head sticks out beyond the base created by the torso and legs. Slices are the individual "rows" into which every 3D print is split. Similarly, do you know how to transfer a file from 3D modeling software to the software that controls the 3D printer? Do you have time and energy to learn?

Do you or someone on your team have the expertise to *repair* the machine? Even the best 3D printers can stop working right. Extruder nozzles (where filament is heated and then pushed out in tiny strands) can clog and circuit boards can need replacement. Who will wield the screwdriver?

Do you or someone on your team feel comfortable with 3D modeling software? What is the skill development involved in 3D printing? Not much – it's almost as easy as pushing a button. It's in the 3D *modeling* – the process of designing one's own files for printing – that skill is needed. Most 3D modeling software is difficult enough to be covered in college courses. Certainly, it's fun to find someone else's work on Thingiverse.com or a 3D fossil file site and download and print it. But ideally, a 3D printer is the final step in a *student's* design process. Are you aware of and comfortable with 3D modeling software that can help your student create something that merits printing? Free software includes Tinkercad.com, Sketchup.com, and AutoDesk 123D.

How does 3D printing fit with your school's existing environmental and recycling plan? Sometimes, it takes more than one try to get a 3D print that has the desired functionality, size, and appearance. Can misprints be recycled? If not, what will you do with bad print jobs?

Do you, your administrator, and your classroom colleagues have a clearly defined metric for success and plan to collect data to support that metric? What will successful 3D printer implementation look like? How will you and others know that it has been successful: by number of prints? projects? instructors? squeals of excitement? How will you gather data as evidence of that success?

There is a reason that many 3D printers sit broken or underutilized. By asking yourself some tough questions before purchasing, you and your colleagues will be able to make a well-informed decision.

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