

3D Printing For Farmers

A new kind of tinkering.



Easy, Affordable, and Accessible

Manufacturing of Unique Designs and Replacement Parts.

Brie Weisman, OTR/L

TAKE AWAY TODAY

Easy, affordable and accessible printing

Learn about the hardware and software used to create 3D designs.

Learn about on-line resources both free and paid to help in your 3D design.

Learn about local resources that may be offered in your own community to assist with design.

Learn about how fiscally the 3D printer can cut down on cost.

Brie Weisman, OTR/L

12 Years Occupational Therapist

18 Years Small Scale Hoop House Grower

12 Years Shepherd

4 Years with AgrAbility of Maine

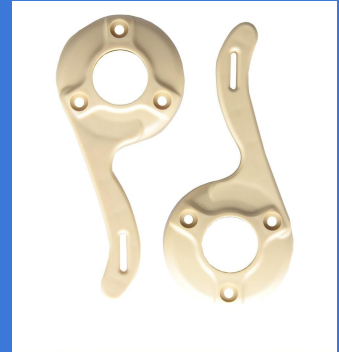
2 Year Working With 3D Printers



3D PRINTING IS:

- A manufacturing revolution that will soon become as necessary for many competitive businesses as 2D printing is today, and will change manufacturing as profoundly as digital photography has changed the way we take, edit, and share photos.
- Growing in leaps and bounds.
- In homes, schools, libraries, and workplaces.
- Affordable home model (starting at under \$300).
- Learnable, with a wealth of support both online and in your community.
- Can produce both stock items and items of your own design (or scan).

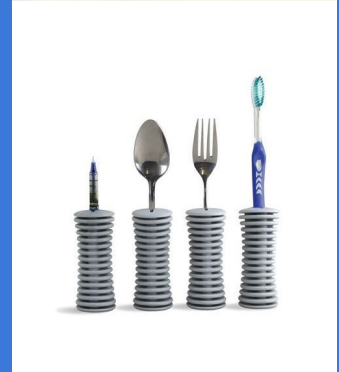
\$41



\$14



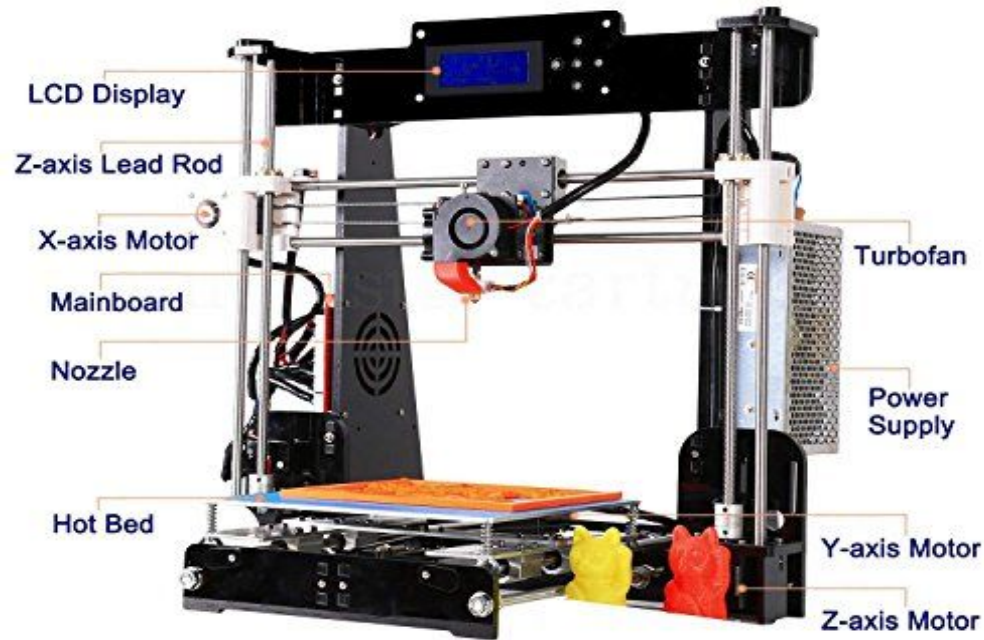
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HOW MOST 3D PRINTERS WORK

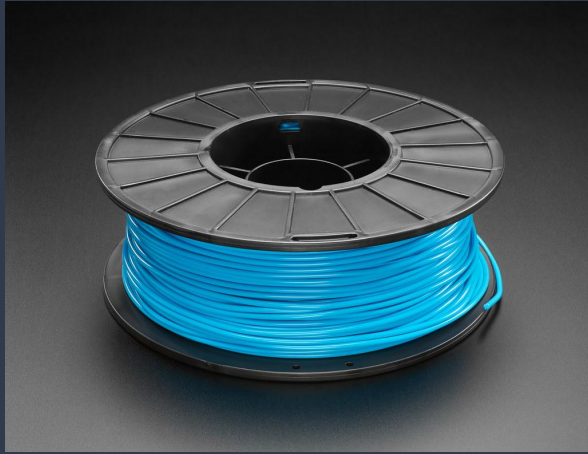
1. A design is loaded into the printer.
2. A printer head feeds filament into a heated nozzle.
3. The melted filament is deposited in a thin layer on the build bed.
4. Motors on three axes move the nozzle to produce layer upon layer until the piece is completed

Machine Parts



3D printer in action.

Filament



Filament: the product material.

Home printers mostly use plastic filaments that cover a variety of characteristics: rigid, flexible, waterproof, glow-in-dark, glitter, multicolored, clear. They include:

PLA	ABS	Nylon	PET	PETT
	PVA	Wood impregnated		

Other Printers use a growing variety of materials:

Resin	Carbon fiber	Metals	Magnetized Materials
Cement/concrete	Glass	Living tissue	

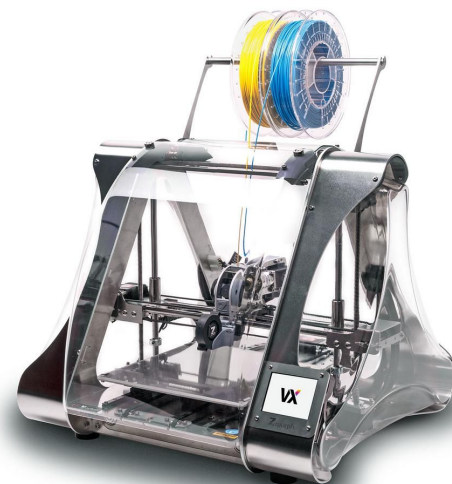
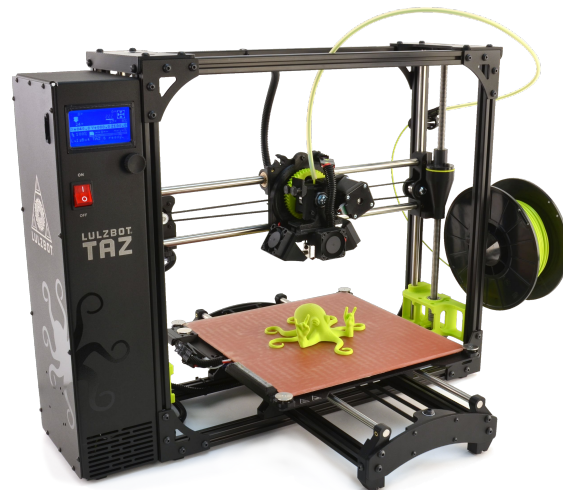
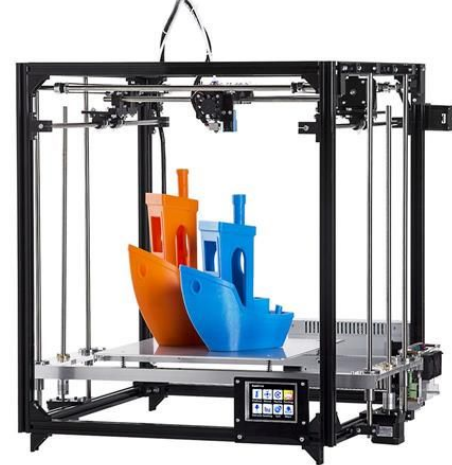
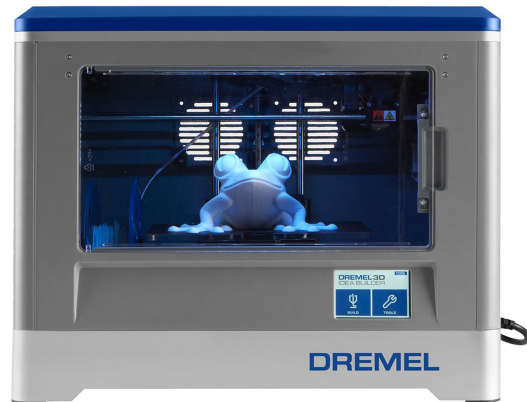
PLA, the wonder plastic.

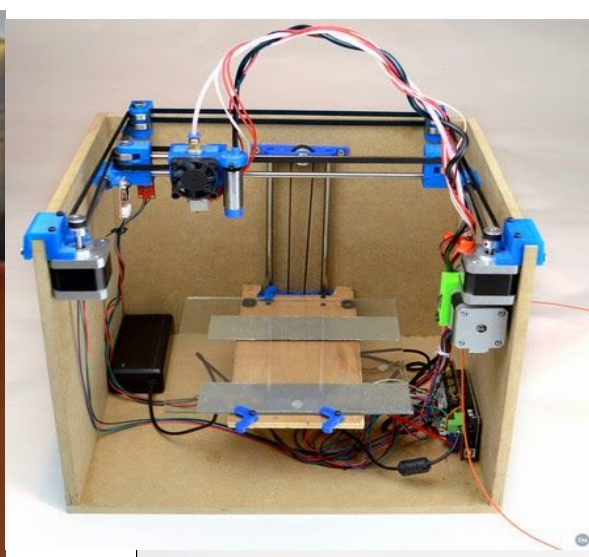
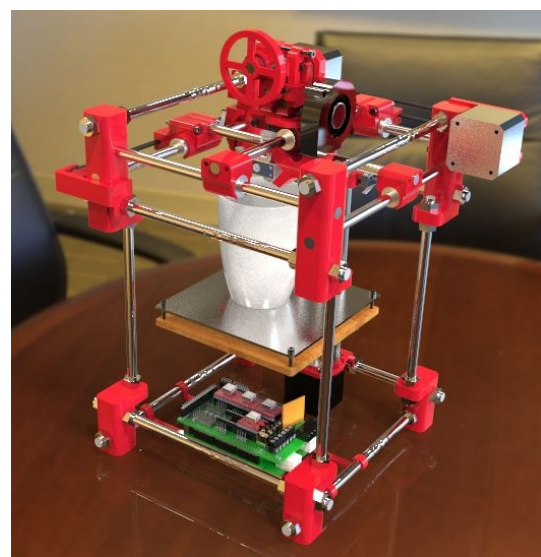


A plastic made from polylactic acid, PLA is currently the most popular plastic for 3D printing, for good reason.

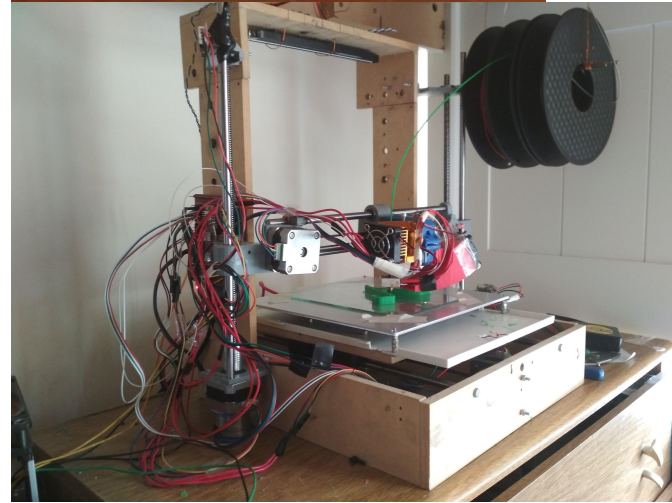
PLA is derived from natural materials like corn, tapioca, and potatoes. PLA is:

- Inexpensive
- Durable, waterproof, and weather-resistant.
- Nontoxic-no ventilation or special precautions needed.
- Biodegradable
- Recyclable for making new filament.
- Made from farmer-grown raw materials!



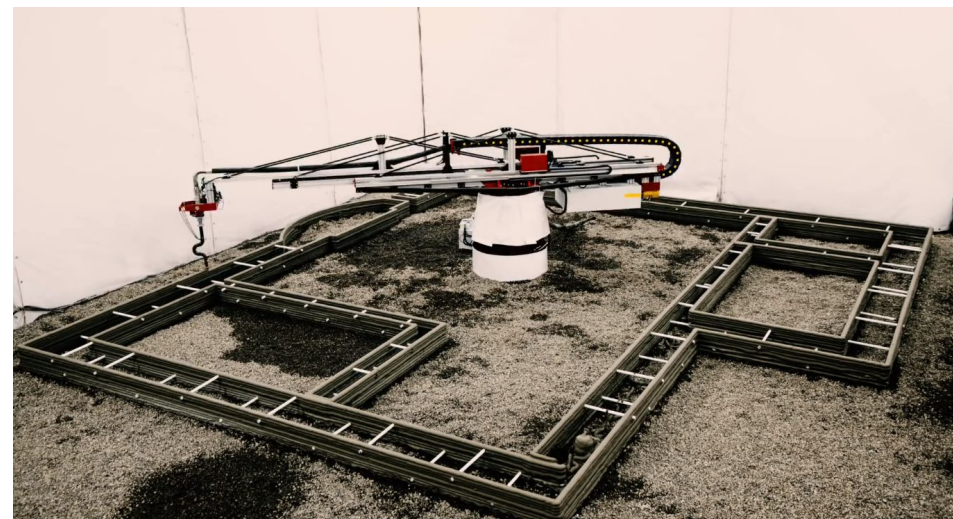


**DIY 3D Printers come in all shapes
... and sizes.**









BUILT IN 12 HOURS



**BUILT IN
45 DAYS**

**WITHSTANDS 8.0
EARTHQUAKES.**



Home in United States

Apartments in China







TODAY

Person-specific replicas of organs/areas to practice tricky or new operations

Dental implants

Hearing Aids

Repair Implants

Stents and small devices

Prosthetics

Perfectly realistic models for teaching

Light, breathable, washable, mesh casts

Homemade dental braces

TOMORROW (OR MAYBE TODAY BY NOW)

Living tissue for grafts and wound closures
(awaiting FDA approval)

Organ replacement
(living tissue models have already been built)

Shareable programs from your doctor to build your own replacement splints, braces, prosthetics as you grow
(can already be done but yet to be put into practice)

<https://www.youtube.com/watch?v=aQC2FXDgNCA>

3D PRINTING IN AGRICULTURE



Replacement/ customized handles

Replacement parts for out of stock items

Drip irrigation parts

Valves, spigots, funnels

Seeder plates

**Speciality wrenches/tools for
hard-to-reach bolts, etc.**

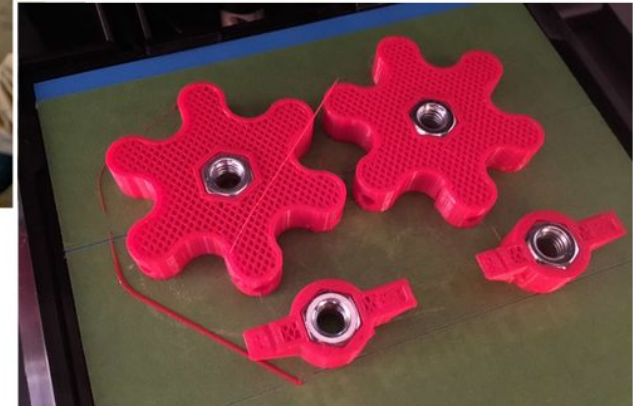
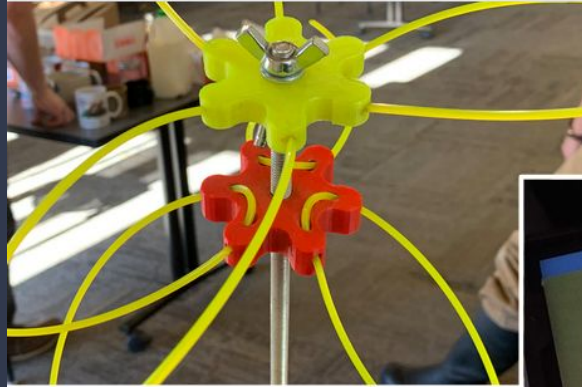
Innovations

<https://www.youtube.com/watch?v=PjSNMVejwlq>

Experiment & Perfect

A great advantage in 3D printing is that once a main file is made, it can be quickly and easily modified to create multiple, inexpensive prototypes to be printed for field testing.

Each of these pieces use pennies of plastic.



Thresher heads designed for use with electric drill to break up seed pods.

2.5 Million Year Old Proto-Axe



If you think it
is hard chopping wood
with a tool this primitive,
you should try doing it barehanded.

TOOL

A tool is an object used to **extend the ability of an individual** to modify features of the surrounding environment.

Although many animals use simple tools, **only human beings use tools to make other tools.**

TOOL



“an object used to extend the ability of **an individual**”

We all understand that tools are of course made for a specific **purpose** but we forget that they can be made for a specific **individual**.

In early history, most tools were built by the farmer, suited to one's own size, strength, and hands. . . .

TOOL



... We have the opportunity to return
to that with 3D printing.

“only human beings . . . **use tools to
make other tools.**”

Fortunately, most farmers are already
adept at modifying equipment to
make work easier. . . .



NECESSITY
IS THE MOTHER OF
INVENTION

Overcoming Physical Challenges: 3D Printing to the Rescue!

Back injuries, spinal cord injuries

**Arthritis,
amputation**

weakness

Diabetes

Low vision

Parkinson

**Equipment adaptations can be
lifesavers:**

- **extended handles for improved reach to limit bending.**
- **Wider handles to allow improved grip on tools,**
- **larger button for FMS,**
- **brighter colors for better vision,**
- **increase friction for improved sensation.**



From Idea to Design

- | | |
|---|---|
| 1. Is project a good 3D candidate? | Cost effective and practical . |
| 2. Does it already exist as a file? | Yeggi, Thingiverse, Tinkercad,OpenScad |
| 3. If not, who will create it? | You, H.S. students, college students, library, 3D print co. |
| 4. How will it be created-Scan or design? | Scans allow near-perfect replicas. Scans download as files that can be modified.Tinkercad |

<https://www.thingiverse.com/>

<https://www.tinkercad.com/>

From Design to Print

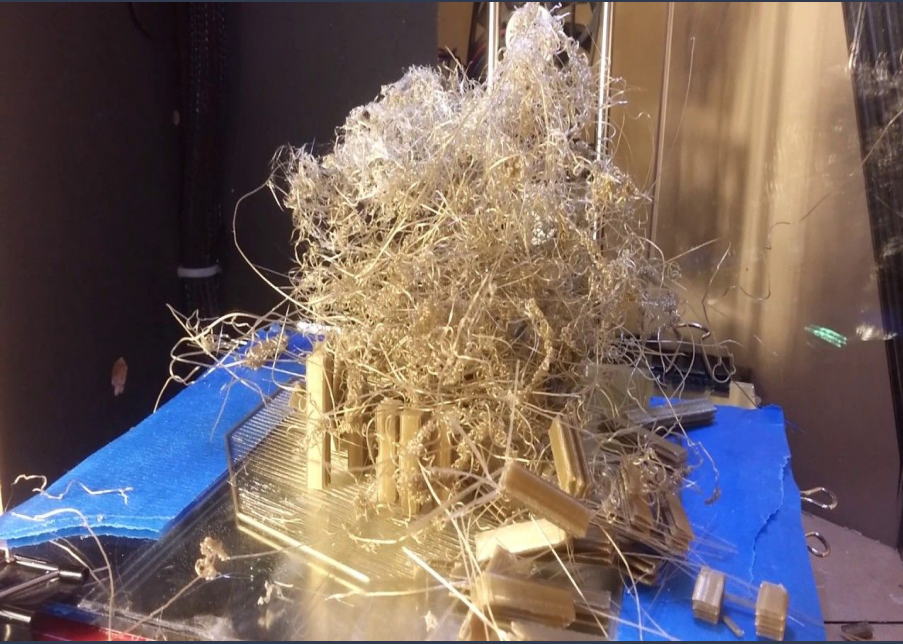
1. Import design into a Slicing Program.
2. Preheat machine and load Filament.
3. Print.

Flash Forge print, Cura, Mesh Lab

PLA, ABS, flexible, wood fill, glow in dark.

Cross your fingers and monitor printer.

CHALLENGES



DESIGN CHALLENGES

- Learning how to navigate the software & locate resources online.
- Learning how the properties of materials translate into practical use in the real world.
- Visualizing an on screen project as a finished product.
- Learning the quirks of your printer.

PRINT CHALLENGES

- Print failures happen.
- Untended machine can lead to a print mess.
- There is a bit of a learning curve.
- A mistake can rarely be fixed after a print is completed.

Farmers looking at
3D printers.
Dramatic pictures
of 3dprinters.

<https://www.youtube.com/watch?v=-LOGF3hFxHU>

<https://www.youtube.com/watch?v=M4blAdS6r3Q>

<https://www.youtube.com/watch?v=PjSNMVejwlg>

<https://www.youtube.com/watch?v=aQC2FXDqNCA>

3D designs
If you can think it
you can make it.

Farmer related Designs

Glow in the dark Outlet cover.

Personalized tool handle

Personalized ear tag

Personalised Bucket carrier

Seed plate

Ergonomic tool holder

From idea to print.

Design your tool on software like Tinker Cad, or find a tool to manipulate in Thingiverse.

Export the tool to a “slicing” program like Flash Forge print or Cura and download to thumb drive

Print on 3D printer.

Farmer 3D printing Maine at KVCC and MOFGA

Steve Larochelle, director of library science, teamed up with Bo Dennis of Mofga to offer 5 farmers a short course on how to use 3D printers to help with their farming.

Resources Books and Articles

Aranda, S., & Feeney,D. (2019), 3D Printing failures: How to diagnose & repair all desktop 3D printing issues. Middletown, DE.

Smyth, C.T. (2017) Functional design for 3D printing: Designing printed things for everyday use. Middletown, DE: Clifford Smyth

Smyth, C.T. (2016) The zombie apocalypse guide to 3D printing: Designing and printing practical things. Lexington, KY, Clifford Smyth

Cline, L.S. (2018). Make: Fusion 360 for makers: design your own digital models for 3D printing and CNC fabrication> San FRancisco, CA: Maker Media.

Williams, A. (2014). OpenSCAD for 3D printing. San Bernadino, CA: CreateSpace.

Pearce, J.M (2015). Applications of Open Source 3-D Printing on Small Farms. Organic Farming, Vol 1, Issue 1, 19-35.

Resources Video Tips and Tutorials You Tube

3D print General	Thomas Sanladerer	3D Maker Noob
CNC kitchen	Joseph Prusa	Maker's Muse
Make Anything	3D print Nerd	Teaching Tech

More resources

Free 3D models for Download:

[Thingiverse.com](https://www.thingiverse.com)

[MyMiniFactory.com](https://www.myminifactory.com)

[Cults3D.com](https://cults3d.com)

[GrabCAD.com](https://www.grabcad.com)

[Yeggi.com](https://yeggi.com) (both free and purchase models).

Free Software:

Cura for slicing parts

Prusa Slicer for slicing parts

[Tinkercad.com](https://tinkercad.com) for editing .stl files

MeshMixer for editing models

Autodesk Fusion 360 for editing and creating models.

3D Builder for Windows 10 for editing models.

Other Resources:

Facebook 3D Printing Group

[TH3D Studio.com](https://www.th3d.com)

Want the 3D Print without the hassle?

Places to Order Prints

[SD3D.com](https://www.sd3d.com)

[Shapeways.com](https://www.shapeways.com)

[ProtoLabs.com](https://www.protolabs.com)

Visit [all 3dp.com](https://all3dp.com) for their article on “Best Online 3D Printing Services”

QUESTIONS

Mind Blown?

Special Thanks

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Bo Dennis, Maine Organic Farmers and
Gardeners.