

3D Printing FAQs presented by Polar 3D

Q: What is 3D printing?

3D printing is also known as desktop fabrication or additive manufacturing. It is a prototyping process where a real object is created from a 3D design. The digital 3D-model can be created using a variety of computer aided design (CAD) software or scanned using a 3D scanner. The model is saved in STL format and then sent to a 3D printer. The 3D printer then prints the design layer by layer and forms a real object.



Q: What are the materials used to print 3D objects?

Many different materials can be used for 3D printing such as ABS plastic, PLA, wood, metals, carbon fiber, paper, and even food (chocolate etc.). These materials, or filament, are typically 1.75mm diameter. The two most common types of filaments are:

- PLA--PolyLactic Acid: Bio-degradable, non-toxic; Many colors; Classroom friendly
- ABS--Acrylonitrile-Butadiene Styrene: Petroleum-based plastic; Many colors; Stronger than ABS; May give off toxic fumes when melted

Polar 3D supports both PLA and ABS but due to environmental and classroom safety concerns we recommend PLA filament. Some 3D printers only support their own brand of filament. The Polar 3D printer uses non-proprietary 1.75 mm filament.

Q: What is STEAMtrax?

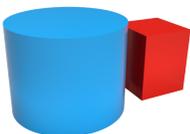
STEAMtrax is an innovative supplemental curriculum offered by Polar 3D that integrates engineering and 3D printing technology with core academic knowledge in science, technology, engineering, the arts, and math (STEAM). Each module incorporates NGSS concepts in the areas of physical, earth/space, and life science. In the true spirit of the Framework for 21st Century Learning skills, students are engaged in relevant learning scenarios that encourage the essential skills of problem solving, collaboration, communication, critical thinking, and creativity. Each lesson embeds project based-learning, hands-on exploration and discovery, computer aided design and 3D printing through the engineering design process. Licenses are available for elementary, middle, and high school and a variety of professional development services are also available. GE is the corporate sponsor of STEAMtrax and the curriculum will work with any brand of 3D printer. For more information about STEAMtrax please visit <http://about.polar3d.com/steamtrax/>

Q: What types of coordinates do 3D printers use?

Most 3D printers use cartesian coordinates (X, Y, Z). "X" is the forward/backward movement; "Y" is the left/right movement; and "Z" is the vertical or up/down movement. By assigning numerical values to each coordinate, 3D printers create three dimensional objects. The Polar 3D printer is unique as it uses polar coordinates. Polar coordinates are the length and angle from a point of origin--the 360° in a circle. When combined with the "Z" or vertical axis we can now print a 3D object. Polar coordinates give the Polar 3D printer 3.14 (pi) times the build volume of a conventional printer.

Q: Why is Polar better?

- The Polar 3D printer with its unique polar coordinate design has an 8" round build plate, most other printers in this class have a 4" x 4" square build plate. The Polar printer can print an object up to 8" in diameter with a 6 ¼ " height.
 - Reliability: the Polar printer has 30% fewer parts than a traditional 3D printer. Fewer moving parts translate to fewer repairs.
 - Small footprint: the all-metal construction weighs about 10 pounds; dimensions are 12.5" deep, 8" wide, and 14" high. 6 Polar printers can easily fit on a mobile classroom cart.
 - Every Polar printer has a built-in computer with integrated networking, webcam,



and the Polar Cloud.

- Designed for the classroom: quiet; small footprint takes up less space; open design to allow students to watch the printer from a wider viewing area; non-heated build plate and enclosed print nozzle keeps hot elements away from little hands.

For more information about the Polar 3D Printer please visit <http://about.polar3d.com/printer/>

Q: What is the Polar Cloud?

Every Polar 3D printer can be accessed directly or through integration with the Polar Cloud., a cloud-based platform that allows users to collaborate and print from any device. Polar Cloud brings the power of cloud-based collaboration to the classroom by allowing educators to share their curricula and collaborate across multiple courses and subjects. The Polar Cloud integrates with Google Classroom and Google Drive.

Q. What can you make with a 3D printer and what are some commercial uses?

In 3D printing area, people say "If You Can Draw It, You Can Make It". One of the most important applications of 3D printing is in the medical industry. With 3D printing, surgeons can produce patient-specific 3D printed models of patients' body parts or organs. 3D printing makes it possible to make a part from scratch in just hours enabling designers to go from the computer screen to an exact, physical part. Almost everything from aerospace components to toys are being built with the help of 3D printers. 3D printing is also used to create jewelry, architecture, fashion design, art, and interior design.

Q: What 3D modeling software is available for students and teachers?

A variety of 3D modeling software can be downloaded for free:

- Tinkercad (cloud based, requires WebGL) very easy to use for simple 3D designs
- BlocksCAD (Cloud based) The tool incorporates programming and math concepts so users learn to code as they create
- Autodesk 123D (Mac, Windows, and Cloud) suite of design tools
- Inkscape (Mac, Windows, Linux) 2-D drawing and design
- OpenSCAD (Mac, Windows, Linux) extrusion tool for Inkscape
- SketchUp Make (Mac, Windows) 3D modeling tool to create geometric shapes like architectural designs
- 3DTin (cloud based) easy to use with a few more advanced features than Tinkercad
- Meshmixer (Mac, Windows) 3D sculpting, like making an organic model out of clay
- Sculpttris (Mac, Windows) 3D sculpting and shaping tool
- KnotPlot (Mac, Windows) mathematical knots
- OnShape (Cloud) CAD, collaboration on any device with a browser

Commercial software such as AutoCAD and Pro Engineer PTC can also be used to create STL files but they are not free downloads.

Q: How long does it take for an object to print?

That depends on several factors: the size and complexity of your model; the material you are using; the layer height (smaller layers mean more layers to print). A small simple model may take just a few minutes to print while a large complex model may take many hours.

Q: How do you control a 3D printer?

Many 3D printers require a dedicated computer to control it and you have to learn and manage new slicing software to print 3D objects. The Polar 3D printer has a built-in computer with Wi-Fi, Ethernet, and USB connectivity, and integrated slicing software to make controlling your printer easy. You can load .stl files, position your build plate, set full Cura settings, and watch live video of your print from any browser. We even take a timelapse video of every print for you. With the free Polar Cloud connectivity built into every Polar Printer, you can control and print from anywhere in the world.

Q: Can I control my 3D printer remotely?

Yes. You can control a Polar 3D printer over the internet or via your local network. The Polar Cloud allows any device with a web browser (PC, Mac, smartphone, ipad, Chromebook etc .) to submit and manage the entire print process. The Polar 3D printer even includes a built in webcam so you can watch your remote prints being created. Many schools use Chromebooks or tablets for students. With the Polar Cloud, students can create their designs using cloud based CAD software and submit their jobs to the printer.

Q: What is a G-Code?

G-codes (gcode) are the codes the printer will use to print your 3D model. G-codes can be in a file as commands instructing where the printer needs to move and extrude (X, Y, and Z) to build your model.

Q: What is a slicer?

A slicer tool is an a tool to work with 3D printers. You need this tool, to literally slice your 3D model, generating a Gcode file that the printer will use. Many 3D printers require a separate slicer to create the g-codes. The Polar 3D printer has a built in slicer to make 3D printing fast and easy.

Q: What are some of the 3D printing technologies in use today?

There are several different 3D printing technologies. The main differences are how layers are built to create parts. FDM (fused deposition modeling), FFF (fused filament fabrication), and SL (stereolithography) are the most widely used technologies for 3D printing. Most classroom printers under \$1,000 use either FDM or FFF technology. The Polar 3D printer uses FFF technology. The process works by melting plastic filament that is deposited, via a heated extruder, a layer at a time, onto a build platform according to the 3D data supplied to the printer. Each layer hardens as it is deposited and bonds to the previous layer. For more information visit: <http://3dprintingindustry.com/3d-printing-basics-free-beginners-guide/>

Q: Where can I download 3D files to print?

While designing and building your own objects using CAD software is the best way to learn about 3D printing, many sites allow users to share designs and collaborate:

- Polar Cloud: <https://cloud.polar3d.com/>
- My Mini Factory: www.myminifactory.com
- Thingiverse: www.thingiverse.com
- GrabCAD: <https://grabcad.com/>
- Autodesk 123D: <http://www.123dapp.com/>
- NIH 3D Print Exchange: <https://3dprint.nih.gov/>
- YouMagine: <https://www.youmagine.com/>



For product data sheets, webinars or to request a demonstration, please visit fisheredu.com/ repfinder to locate your dedicated sales professional.

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