TECH GUIDE

3D PRINTING FOR SCHOOLS

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ABOUT 3D PRINTING

3D printing technology has been around since 1981, although not until 2010 did the process become more mainstream. 3D printing is an additive process, the material is built up layer-by-layer producing three-dimensional solid objects of virtually any shape using a digital model. In traditional manufacturing the process is subtractive, material is carved away to create molds for casting or to create the finished product. 3D printing is used in prototype production for most manufacturing industries, yet the possibilities are endless - bound only by the imagination.

Many types of materials and methods used in 3D printing, resulting in many approaches to producing the end product: Fusing materials in a granular bed, Extruding small beads of material which harden immediately to form layers, and the use of ordinary sheets of office paper, cut the shape, strategically deposit adhesive and then apply pressure to bond the prototype.

3D printers produce objects from simply back scratchers to artifical limbs to complex ears, livers and kidneys, with living tissue. Researchers in China have been able to successfully print human organs using specialized 3D bio printers using living cells instead of plastic.

These are only a few methods being developed. With the expiration of the patent, open access applications are coming to the forefront including printers for personal consumers. Costs have plummeted from over $20,000 per machine to $1000 making printers both attractive and affordable.

MAJOR COMPANIES IN 3D PRINTING

3D SYSTEMS

applied rapid technologies

Stratasys
FOR A 3D WORLD™

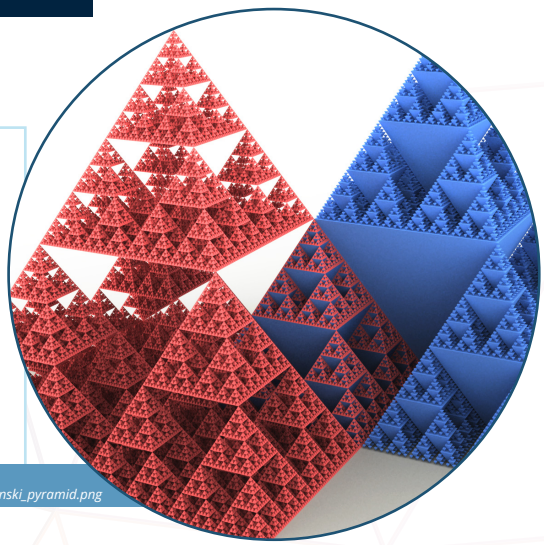
eMachineShop
machine custom parts online

Ponoko
WWW.PONOKO.COM

3D APPLICATIONS FOR EDUCATION

MATH

There are many ways in which 3D printing and mathematics have converged. Most commonly it's been used to help students envision graphs and mathematical models. Some students have a difficult time grasping numbers and diagrams they can only see on paper. 3D printing helps students who have a difficult time envisioning equations, elaborate graphs, and complex mathematical models providing them with more tangible representations. 3D printing brings a "coolness factor" to a subject which might seem less than cool.



"Sierpinski pyramid". Licensed under CC BY-SA 3.0 via Wikimedia Commons - http://commons.wikimedia.org/wiki/File:Sierpinski_pyramid.png#/media/File:Sierpinski_pyramid.png

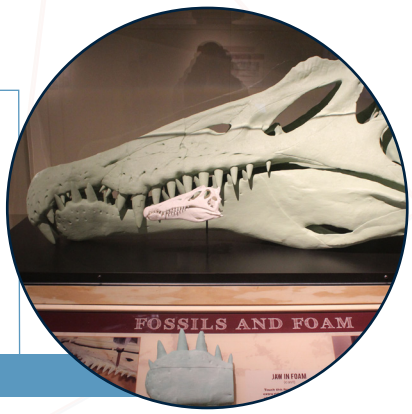
GEOGRAPHY/GEOLOGY

3D printing is an excellent way for students to gain a better understanding geological formations on a scale not presentable through 2-dimensional images. There have been many interesting 3D printed geological forms come to the aid of those studying geography and geology. 3D printing has even helped researchers land a shuttle on a comet, by aiding in picking the best possible landing spot.

A full colour topographical map printed using standard office paper. 774 ABC Melbourne: Simon Leo Brown

HISTORY

History is probably the subject that has the most to gain from 3D printing technology. Museums all over the globe are finally beginning to see the potential 3D scanning and printing can have on, making replicas of ancient artifacts, backing them up and providing a more hands-on experience. Now with the availability of high-end 3D printers and scanners, replicas can be touched, and many of these replicas are virtually indistinguishable from their real counterparts.



By Ryan Somma from Occoquan, USA (Fossils and Foam) [CC BY 2.0 (http://creativecommons.org/licenses/by/2.0)], via Wikimedia Commons

ART

3D Printing provides a brand new method of creating art. With 3D printing available in art classes around the world, our future artists will be the ones to really help the technology reach its potential in all of the different fields of art out there.

(source: 3DPrint.com)

By S zillayali (Own work) [CC BY-SA 3.0 (http://creativecommons.org/licenses/by-sa/3.0)], via Wikimedia Commons

3D RESOURCES FOR EDUCATION

FREE 3D Printing Course: 14 week curriculum

Prepare your students for careers being reshaped by 3D printing technology. Combining in-depth lectures and class discussions with exciting hands-on projects, your students will gain the theoretical and practical knowledge they need to wield this transformative technology in the real world. *see more*

MakerBot® Starter Lab

Get up and running fast with everything you need to start 3D printing. This starter lab includes hardware, materials, accessories, software, training and support. *see more*

135,000,000
US Adults are Makers

"People who employ their creative skills in craft activities, such as making clothing, jewelry, baked goods or works of craft or art. That's 57% of the American population age 18 and up."

USA Today, Oct 2013

FREE software

Autodesk

An early proponent of the White House's ConnectED Initiative, committing to giving away $250 million worth of software and services. The original idea — to put 3D design software into the hands of high schoolers — has expanded, and the company will now provide one copy of any of its software to secondary and post-secondary students, instructors and institutions. *see more*

FreeCAD

FreeCAD is a general purpose feature-based, parametric 3D modeler for CAD, MCAD, CAx, CAE and PLM, aimed directly at mechanical engineering and product design but also fits a wider range of uses in engineering, such as architecture or other engineering specialties. It is 100% Open Source and extremely modular, allowing for very advanced extension and customization. *see more*

Google SketchUp

This Google SketchUp is fun and free, and is known for being easy to use. To build models in SketchUp, you draw edges and faces using a few simple tools that you can learn in a short time. With with Push/Pull tool you can extrude any flat surface into a 3D form. Furthermore, it works together with Google Earth, that you can import a scaled aerial photograph directly from Google Earth, or use SketchUp to build models which can be seen in Google Earth. *see more*

SolidWorks

Not free, but almost the academic discount from Journeyed.com is 95%. Develop the abilities you'll need for a successful career. By learning SolidWorks®, students you'll gain vital mechanical CAD, design validation, and data management skills that today's employers demand. *see more*

More free 3D printing software

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3D PRINTING MARKETPLACES

35,000%
Increase in
3D Printers Sold
for 2007 - 2011

66 3D printers sold in 2007 to 23,265 sold in 2011.

Yahoo Finance, Nov 2013

Shapeways

A New York based 3D printing marketplace and an on-demand provider of 3D printing services. Designers upload design files, and users can place orders with Shapeways to produce the 3D printed item for them. Shapeways offers a variety of materials, including metals, plastics, ceramics, etc. The company houses 50 industrial printers and produces over a million products on demand. *see more*

3DLT

A platform for 3D printing as-a-service through which retailers offer 3D printable products online and in-store.Users of 3DLT design and upload 3D printable files and 3DLT works to print and sell these products. *see more*

Thingiverse

Free sharing of user-created digital designs for 3D printing. The website is owned by Makerbot (a subsidiary of Stratasys). Numerous technical projects use Thingiverse as a repository for shared innovation and dissemination of source materials to the public. *see more*

MyMiniFactory

Offering free sharing of 3D printable files, but unlike the other platforms, MyMiniFactory's content is fully curated meaning that every downloadable object has previously been tested on 3D printers. The website is property of iMakr and also offers a free streaming service for 3D designers. They also provide print-on-demand and design-on-demand services. *see more*

$4 billon
Growth by 2025

"3D Printing Industry to Grow to $4B in 2025"

IDTechEx, March 2014

Threeding

An Eastern European startup that offers free and paid 3D printable content. The company launched its services in 2013 and it became popular among CAD designers and hobbyists with its simple design and interface. Significant parts of the 3D objects available at Threeding.com are digital copies of historical artifacts.Other sites have blossomed as market places for 3D printing such as Scultpteo.com and 3DPrintWise.com which have a commercial flavour. Both focussing on the explicit trading of files for 3D printing with integrations to 3rd party printers, modelling and rendering software. *see more*

CGTrader

Started as the e-shop of computer graphics before transitioning into a more 3D printer friendly model marketplace. The company connects designers and buyers of 3D model designs, primarily focusing on 3D printing and computer graphics. Lithuanian venture capital fund Practica Capital invested in the company in early 2013 and Intel Capital invested further in 2014. *see more*

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