3D Printing in the Math Classroom

Josh Ajima - @DesignMakeTeach

Cindy Sokol - Cynthia.Sokol@lcps.org

Bell Ringer:

Make a Math manipulative out of Bendaroos.

Share with a partner what it represents and how you would use it to teach a math concept.

Bonus Points: Tweet a photo of you creation with a caption to @VCTMath & @DesignMakeTeach

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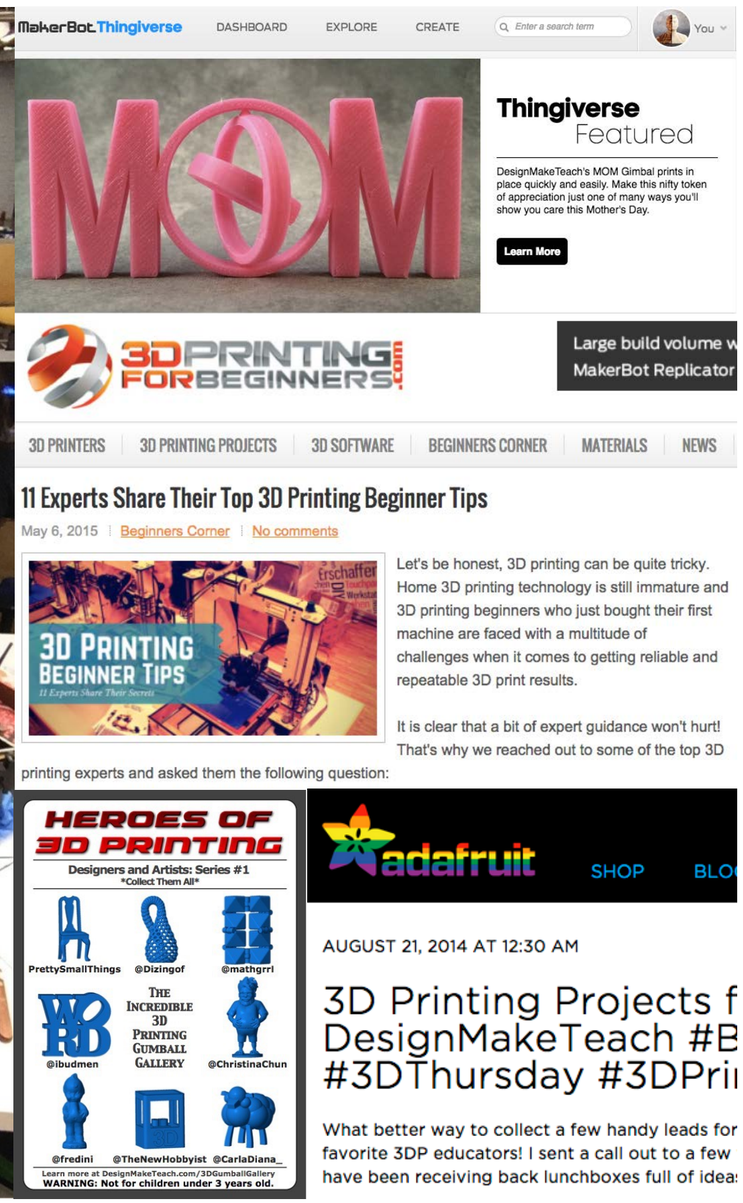
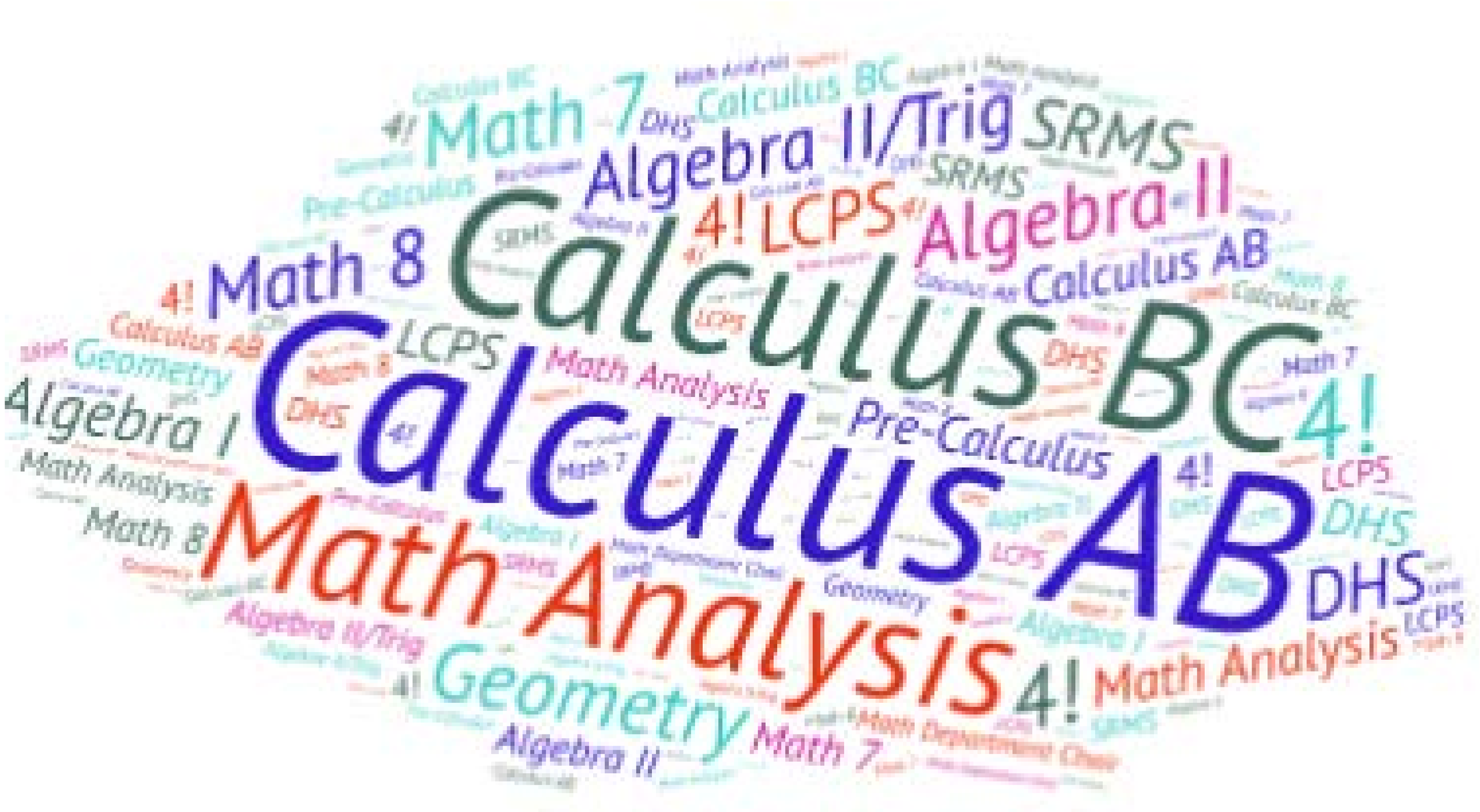
Josh Ajima - K12 3D Printing Expert



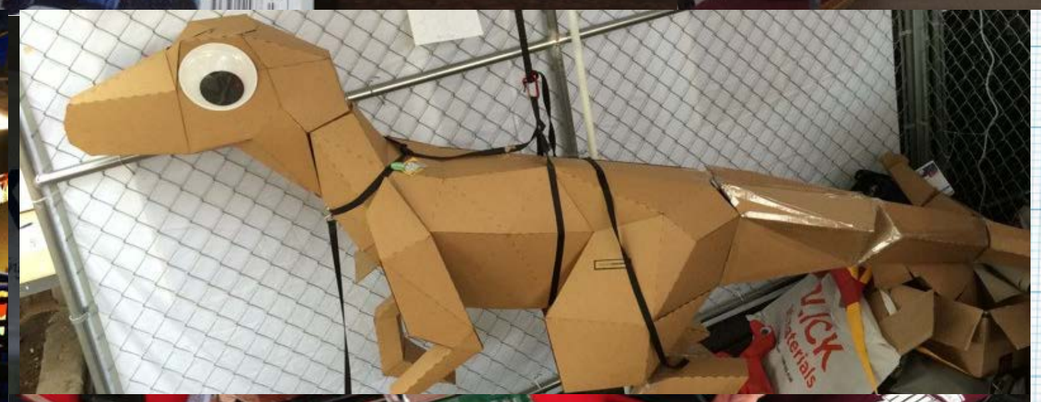
DesignMakeTeach.com - @DesignMakeTeach

CINDY SOKOL - DOMINION HS MATH DEPT. CHAIR



Cynthia.Sokol@lcps.org

The Maker Movement



NATIONAL DAY OF MAKING

JUNE 18, 2014

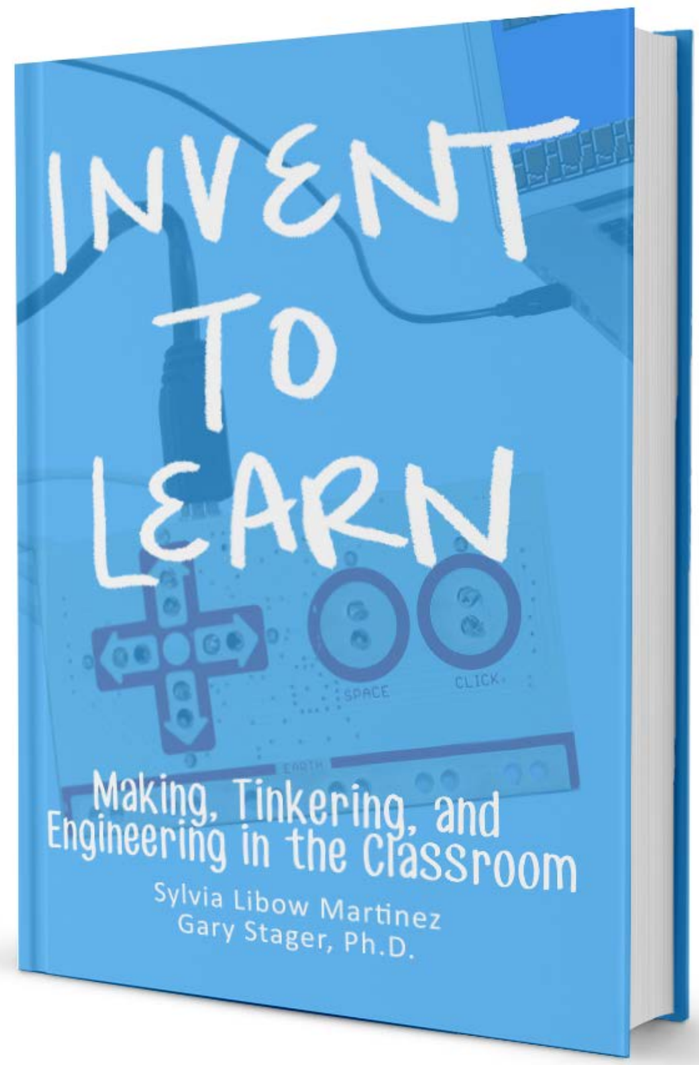
Why 3D Printing?

<u>3 GAME CHANGERS</u>

-Physical Computing

-Programming

-Digital Fabrication



InventToLearn.com/resources

Digital Fabrication

-3D Printer

-Cutting Plotter

-Laser Cutter

-CNC Mill

Thingiverse.com/thing:908712

One to the WORLD

4 KEY ELEMENTS

SIGNIFICANT CONTENT & IMPORTANT COMPETENCIES

Through *One to the World* work, students develop as knowledgeable critical thinkers, communicators, collaborators, creators, and contributors. *One to the World* work ties directly to our curriculum.

AUTHENTIC CHALLENGING PROBLEMS in THE WORLD

One to the World student work is framed by an authentic, challenging problem. The work features real-world context, tasks and tools or impact.

PUBLIC PRODUCT for THE WORLD

Students make their work public by displaying and/or presenting it to people beyond the classroom. Students create and share products, performances, services, and exhibitions of work relating to authentic problems and tasks in the world.

CONNECTED with THE WORLD

Students improve the quality of their work and amplify the impact of their work through three types of connections:

- connections to valuable tools and information;
- connections to others with whom they collaborate; and
- connections with an audience beyond the teacher.

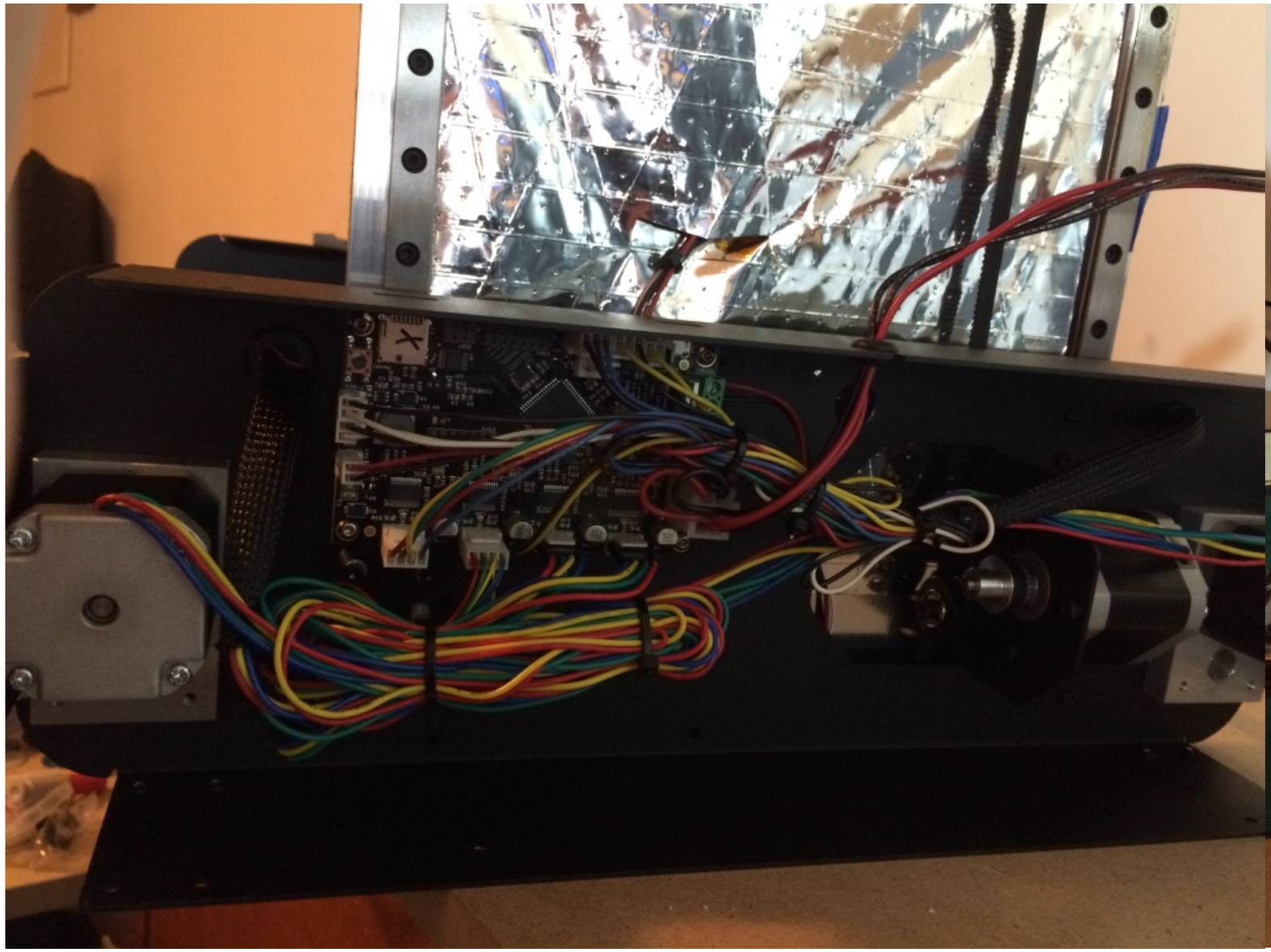
When appropriate, students use technology to make these connections with the world.

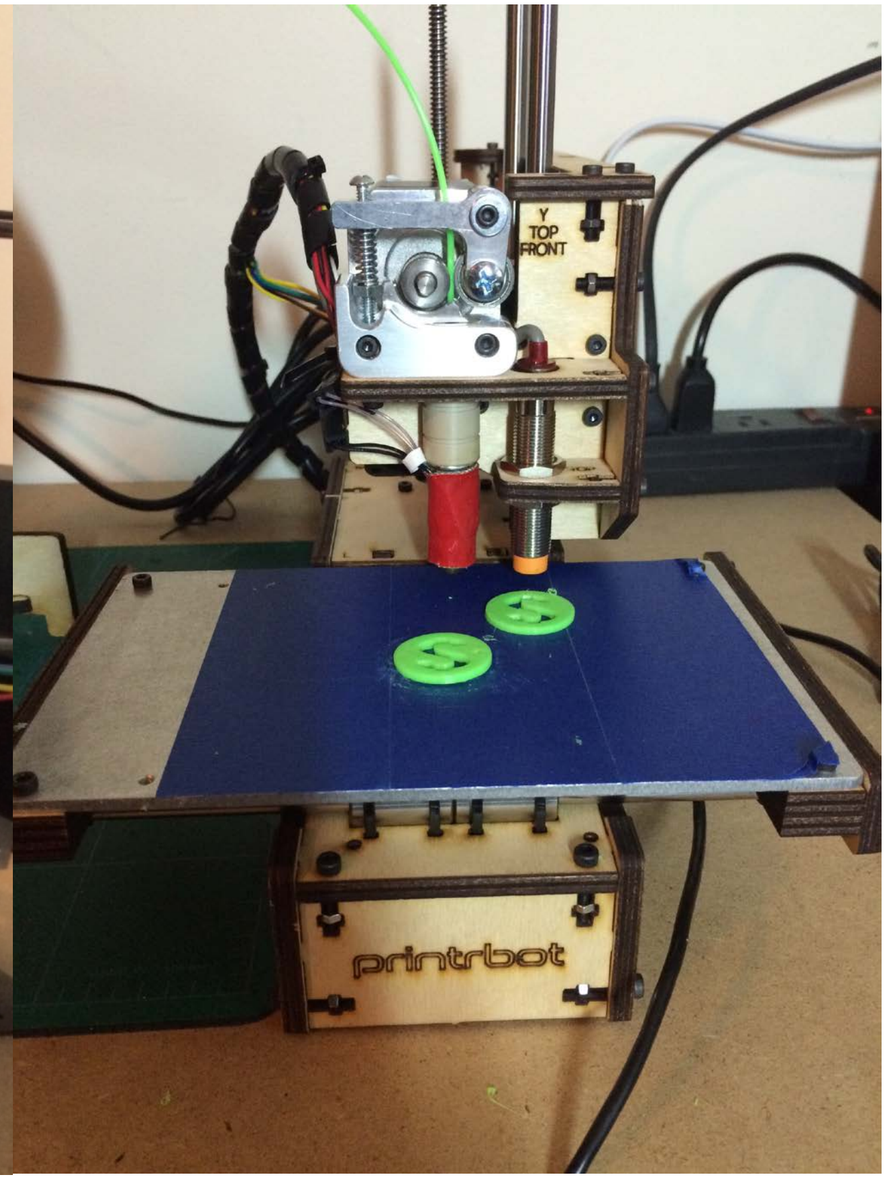
Revised July 2015. The concepts and phrasing of the 4 key elements draws from the "Essential Project Design Elements" of Gold Standard Project Based Learning from the Buck Institute for Education. Alan November was an early user of the phrase, "One to the World."

3D Printing is HARD!!!!

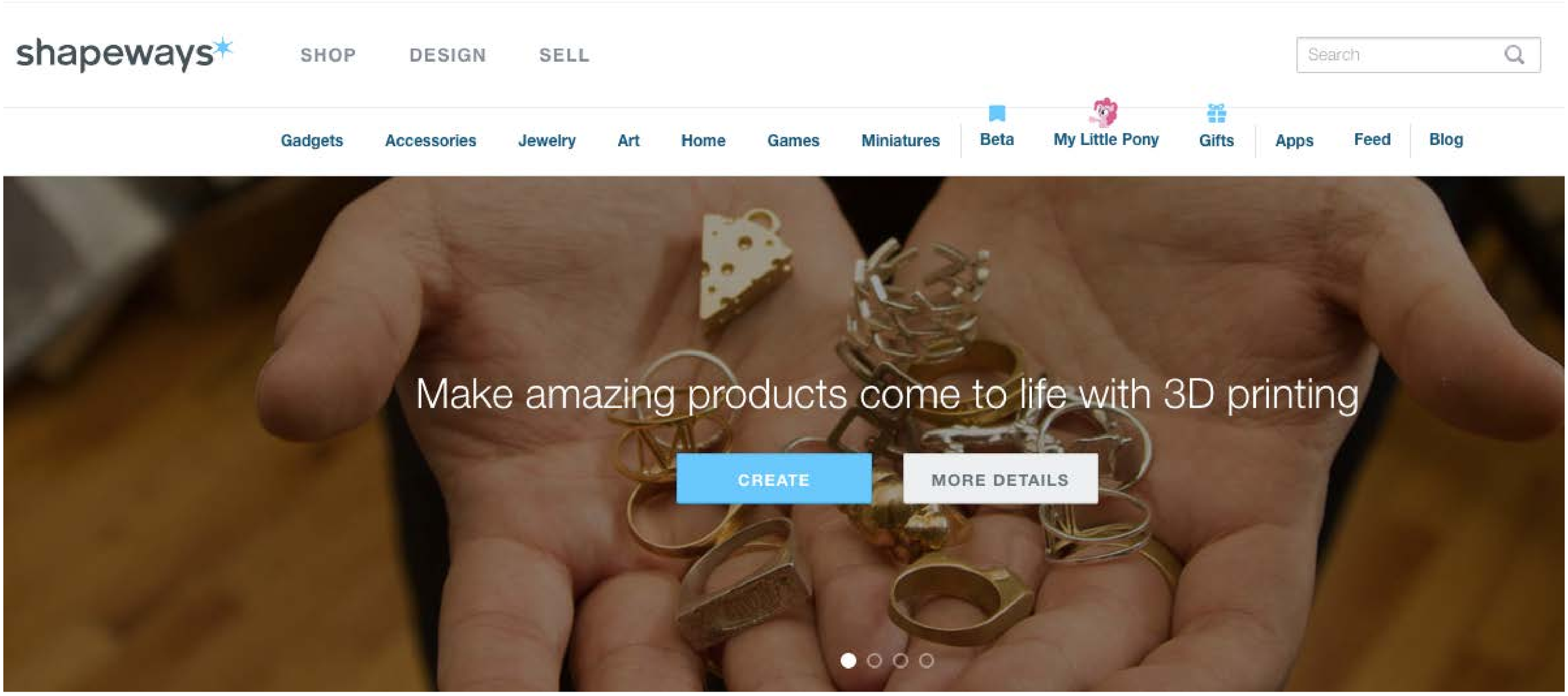
http://www.thingiverse.com/thing:269721

3D Printer Demo





3D Printing Services



Shapeways.com

Buying a 3D Printer

Printrbot Play

$399

28

Best Value / Best for Schools / Most Portable

Printrbot Simple

$599

28

Best Value / Most Portable

Ultimaker 2 Extended

$2788

30

Outstanding Open Source / Best Large Format

makezine.com/comparison/3dprinters/

3D Model

↓

STL

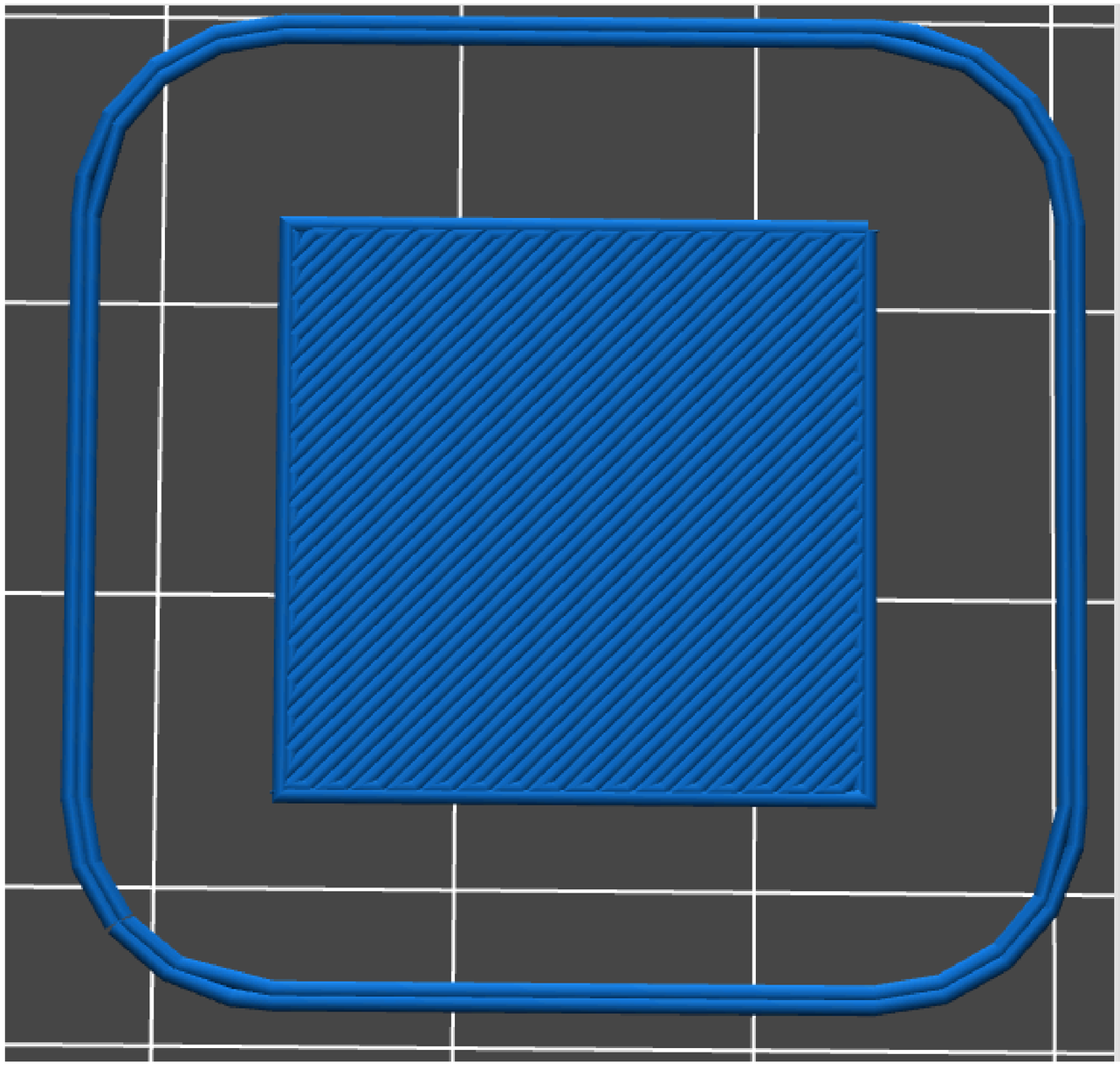
↓

G-Code

↓

3D Print

G-Code



G-Code

```
10 M104 S200 ; set temperature
11 G28 X0
12 G28 Y0
13 G29
14 G1 Z5 F5000 ; lift nozzle
15 M109 S200 ; wait for temperature to be reached
16 G90 ; use absolute coordinates
17 G92 E0
18 M82 ; use absolute distances for extrusion
19 G1 F1800.000 E-0.50000
20 G1 Z1.200 F7800.000
21 G92 E0
22 G1 X38.711 Y28.677 F7800.000
23 G1 Z0.200 F7800.000
24 G1 E0.50000 F1800.000
25 G1 X40.471 Y27.151 E0.57363 F1800.000
26 G1 X42.641 Y26.305 E0.64725
27 G1 X44.000 Y26.169 E0.69043
28 G1 X64.000 Y26.169 E1.32263
29 G1 X66.295 Y26.566 E1.39626
30 G1 X68.323 Y27.711 E1.46989 F1800.000
31 G1 X69.849 Y29.471 E1.54351
32 G1 X70.695 Y31.641 E1.61714
33 G1 X70.831 Y33.000 E1.66032
34 G1 X70.831 Y53.000 E2.29252
35 G1 X70.434 Y55.295 E2.36615
36 G1 X69.289 Y57.323 E2.43977
37 G1 X67.529 Y58.849 E2.51340
38 G1 X65.359 Y59.695 E2.58702
39 G1 X64.000 Y59.831 E2.63020
40 G1 X44.000 Y59.831 E3.26240
41 G1 X41.705 Y59.434 E3.33603
42 G1 X39.677 Y58.289 E3.40966
43 G1 X38.151 Y56.529 E3.48328
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Thingiverse.com - Repository

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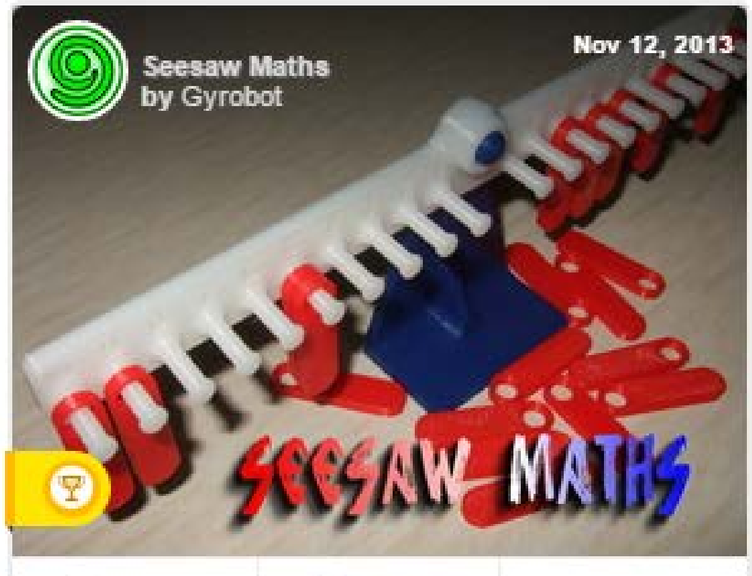
1003 1084 2

1513 1744 15



430 449 18

794 1017 5

772 828 15

Software Tools

-Tinkercad
(+ProjectIgnite)
-123D Design
-Autodesk Fusion 360

-Mathematica

-BlocksCAD
-BeetleBlocks

-Morphi (IOS & Mac)

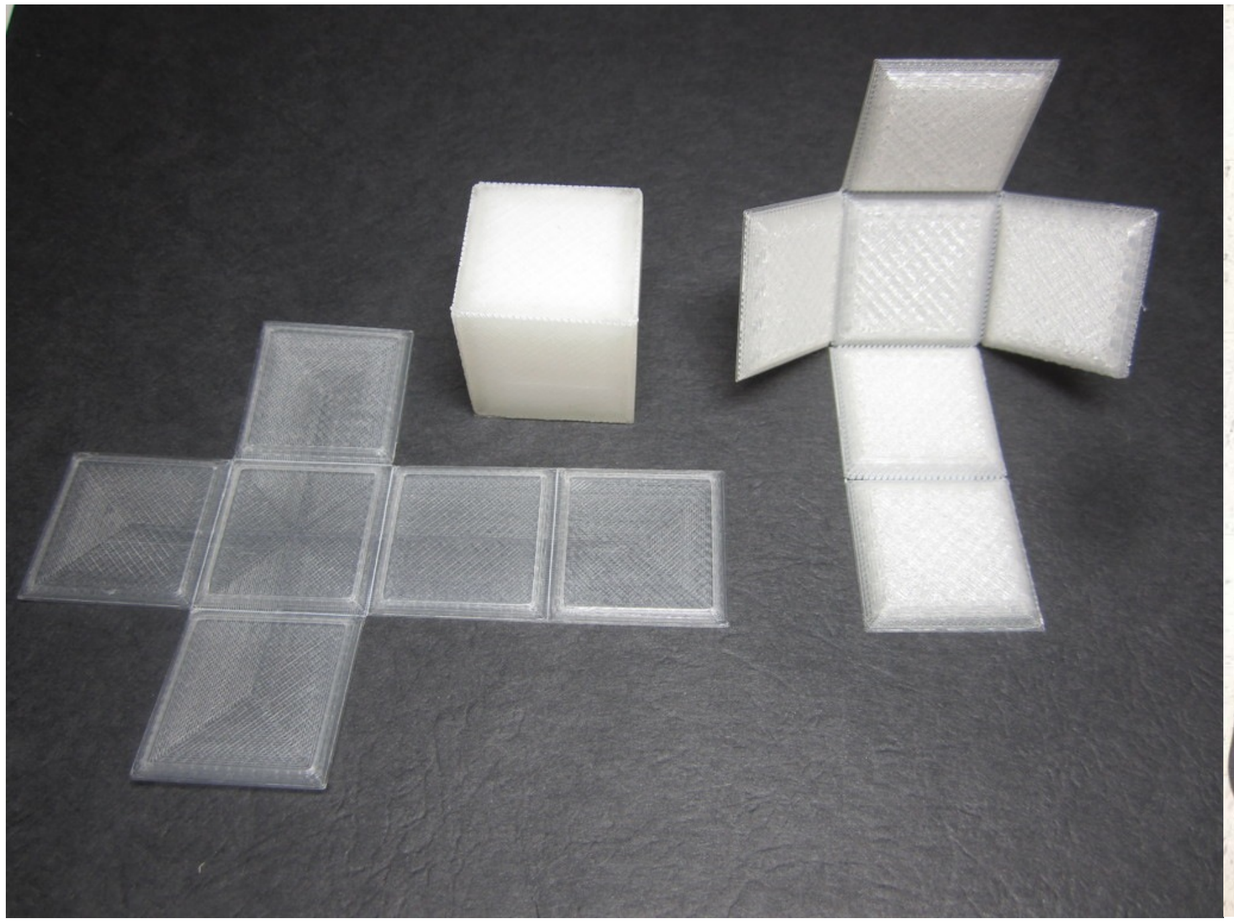
-Desmos

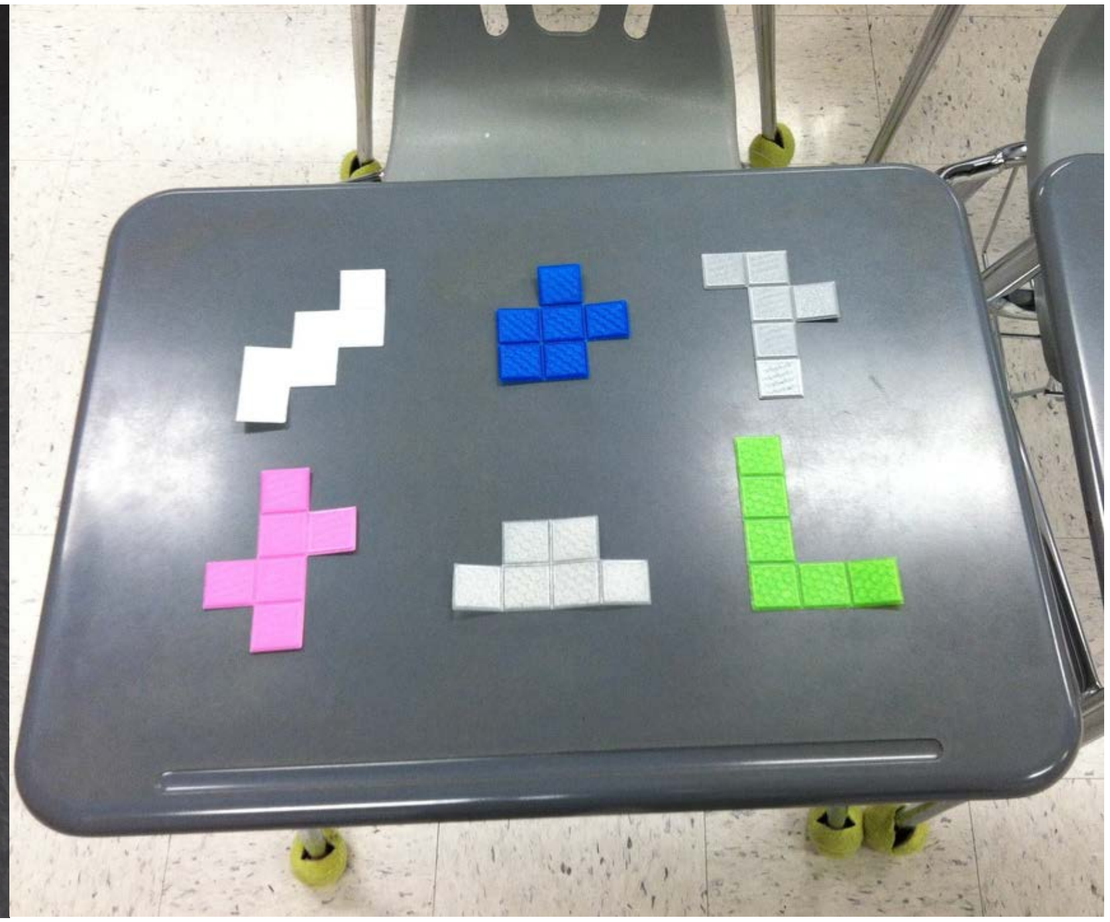
-Inkscape
-Illustrator
-Photoshop

-SketchUp
-123D Catch

-Maya
-Blender

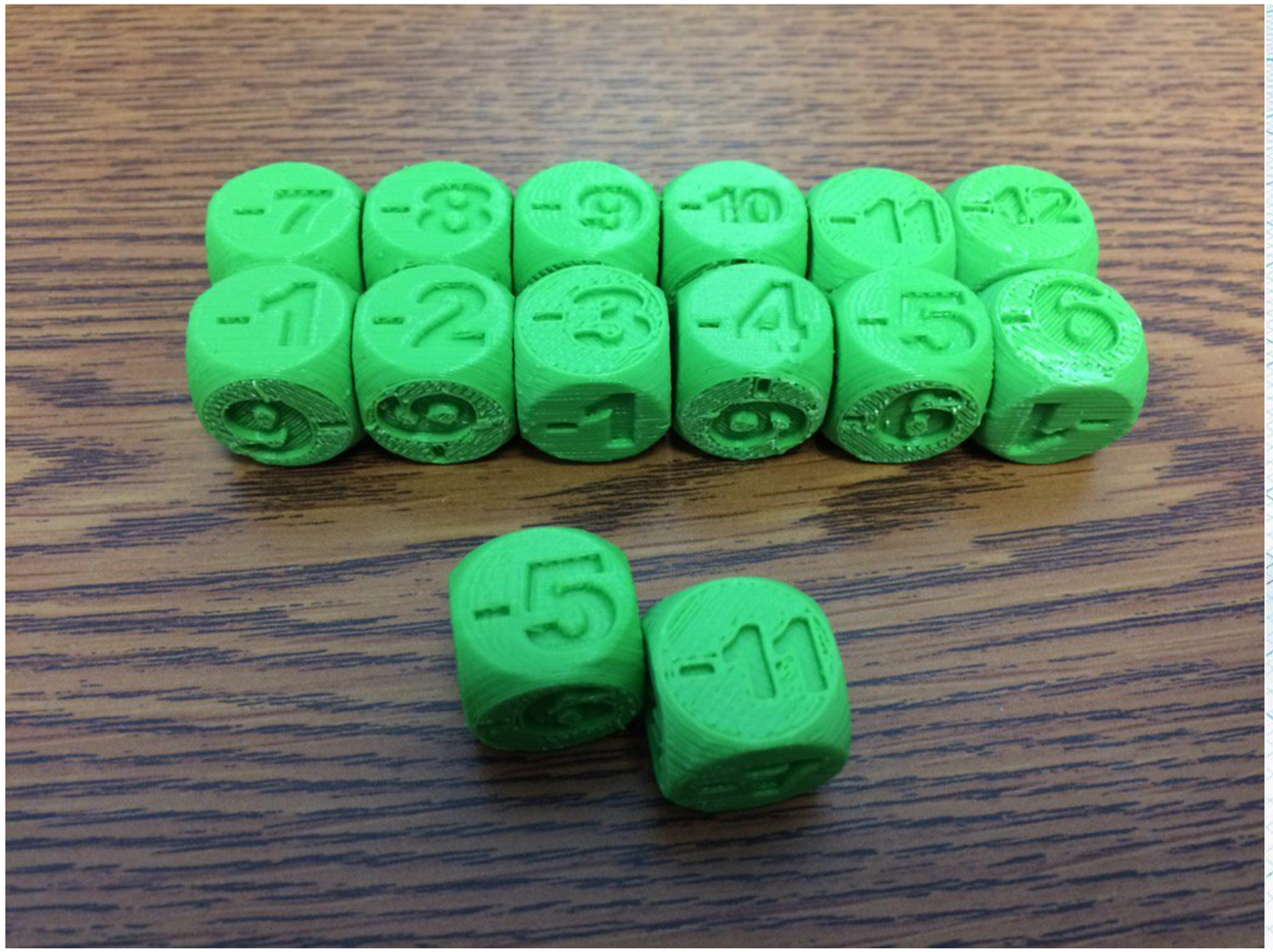
Nets of a Cube

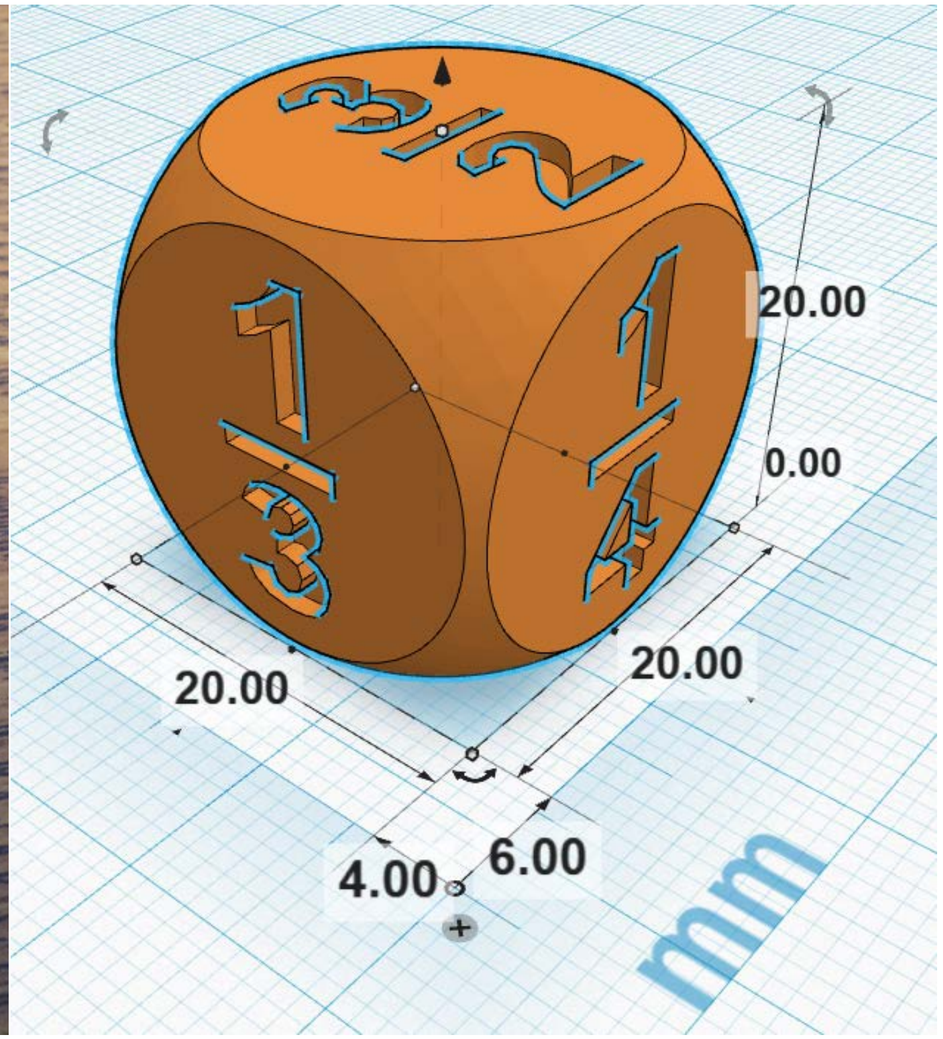




thingiverse.com/thing:75093 & thingiverse.com/thing:186337

Dice: Negative Integer & Fraction





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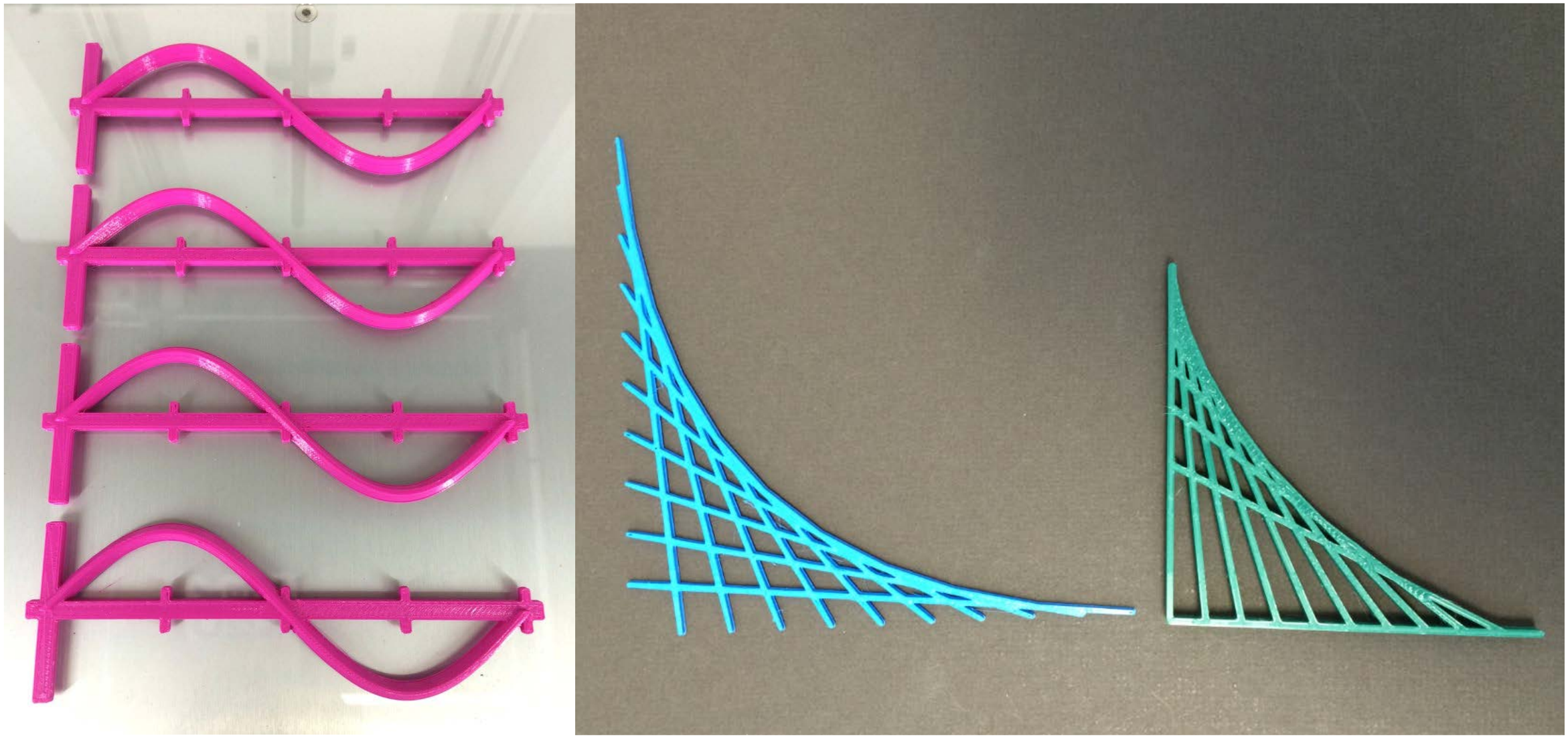
3D Graphing



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thingiverse.com/thing:1375107 & thingiverse.com/thing:1376715

3D Graphing

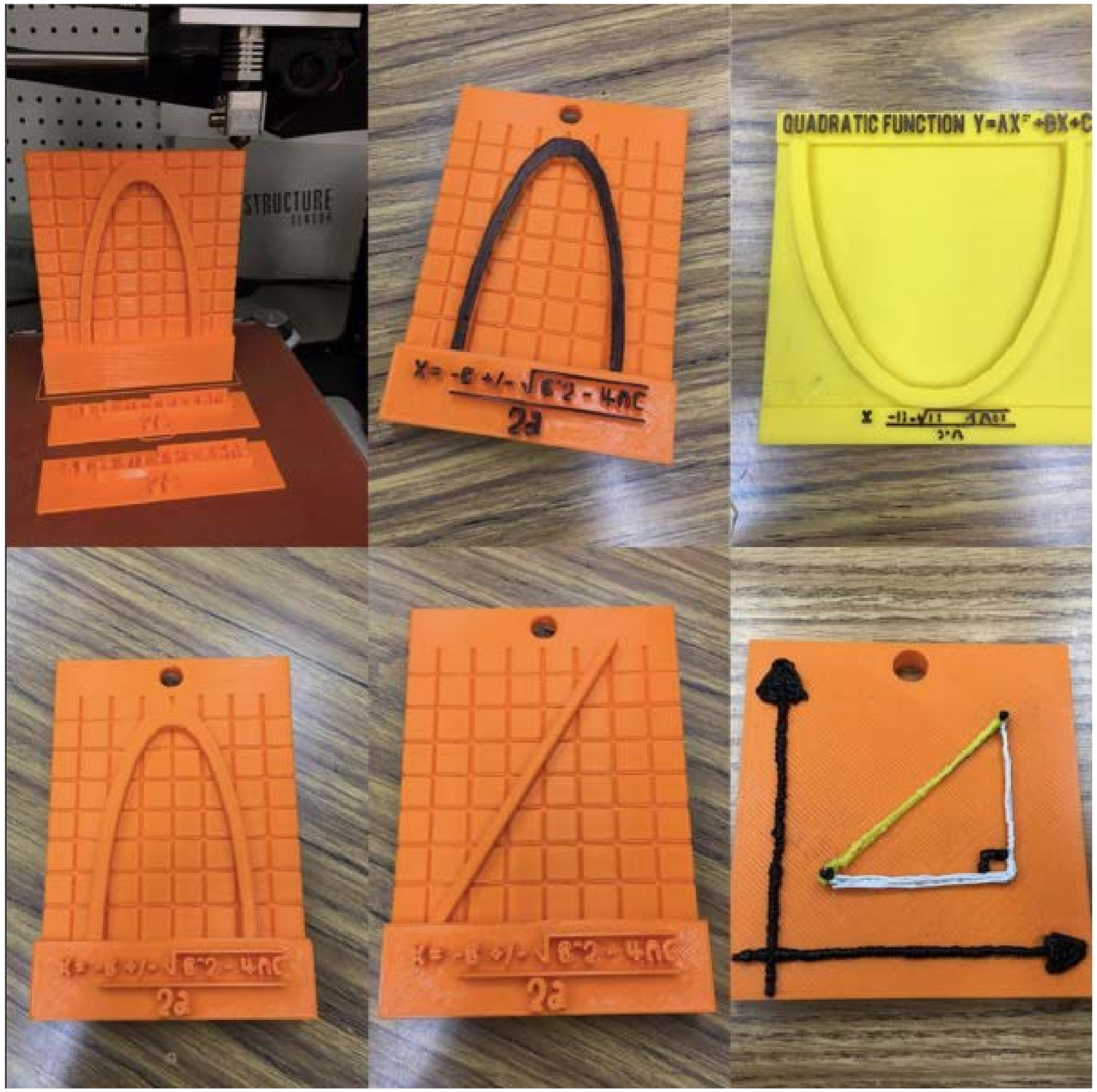


Photo courtesy of Dori Friedman

Jigsaw

-Explore the models at a table.

-What do you have?

-How could it be used?

-What ideas do you have for 3D printing in your classroom?

Resources

DesignMakeTeach.com/3DMath

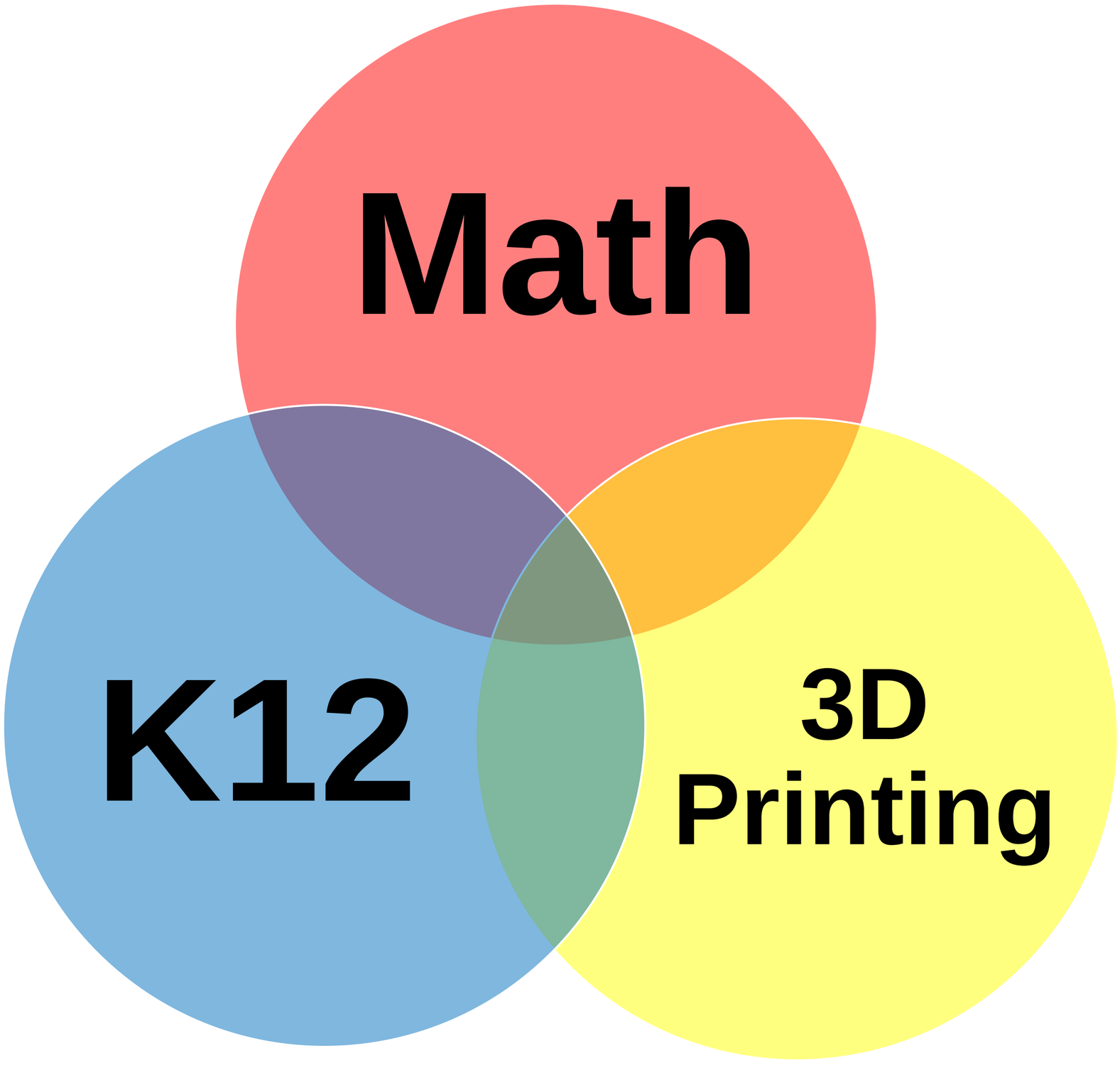
Science

Technology

Engineering

Math

You Could Be a Super Star!



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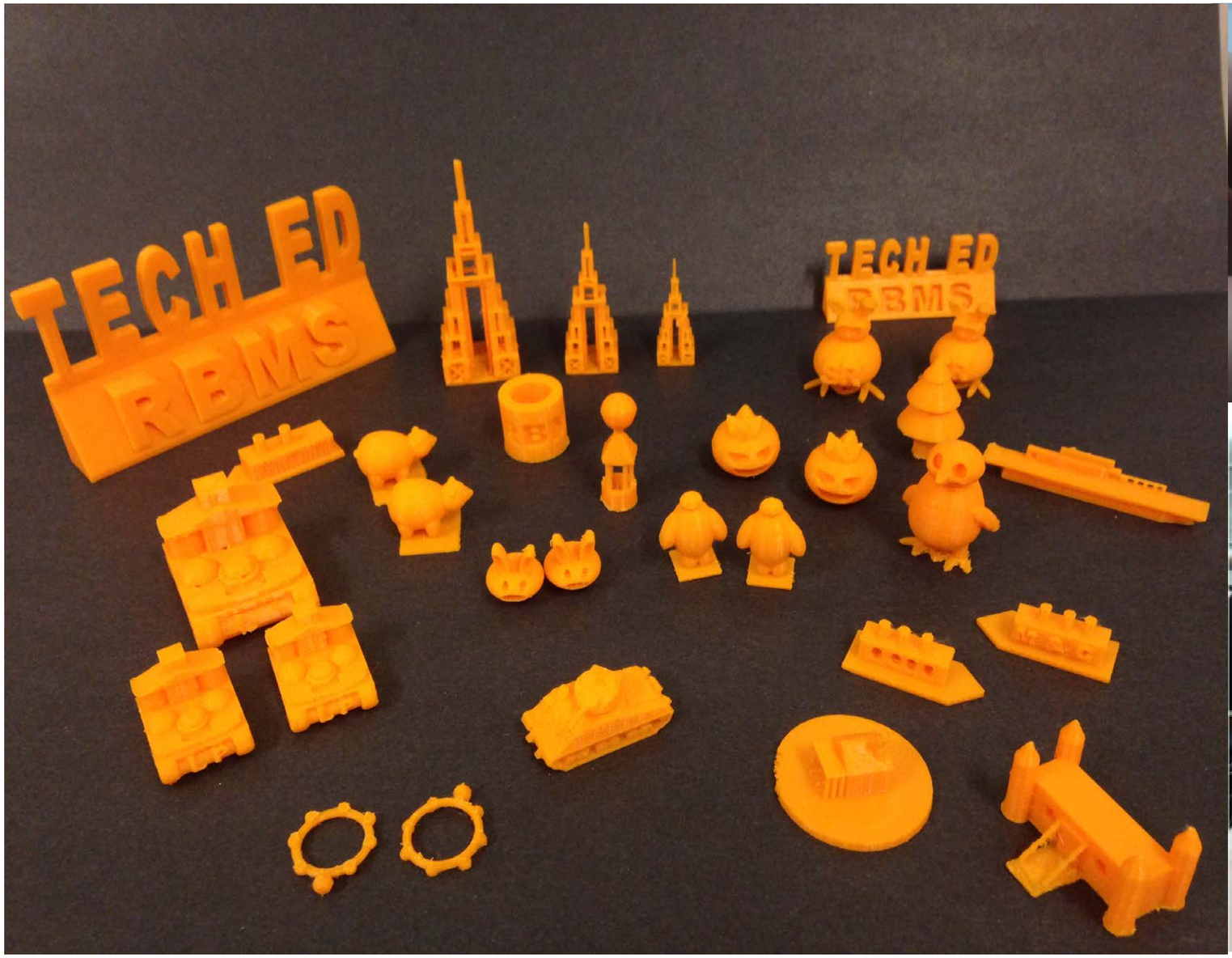
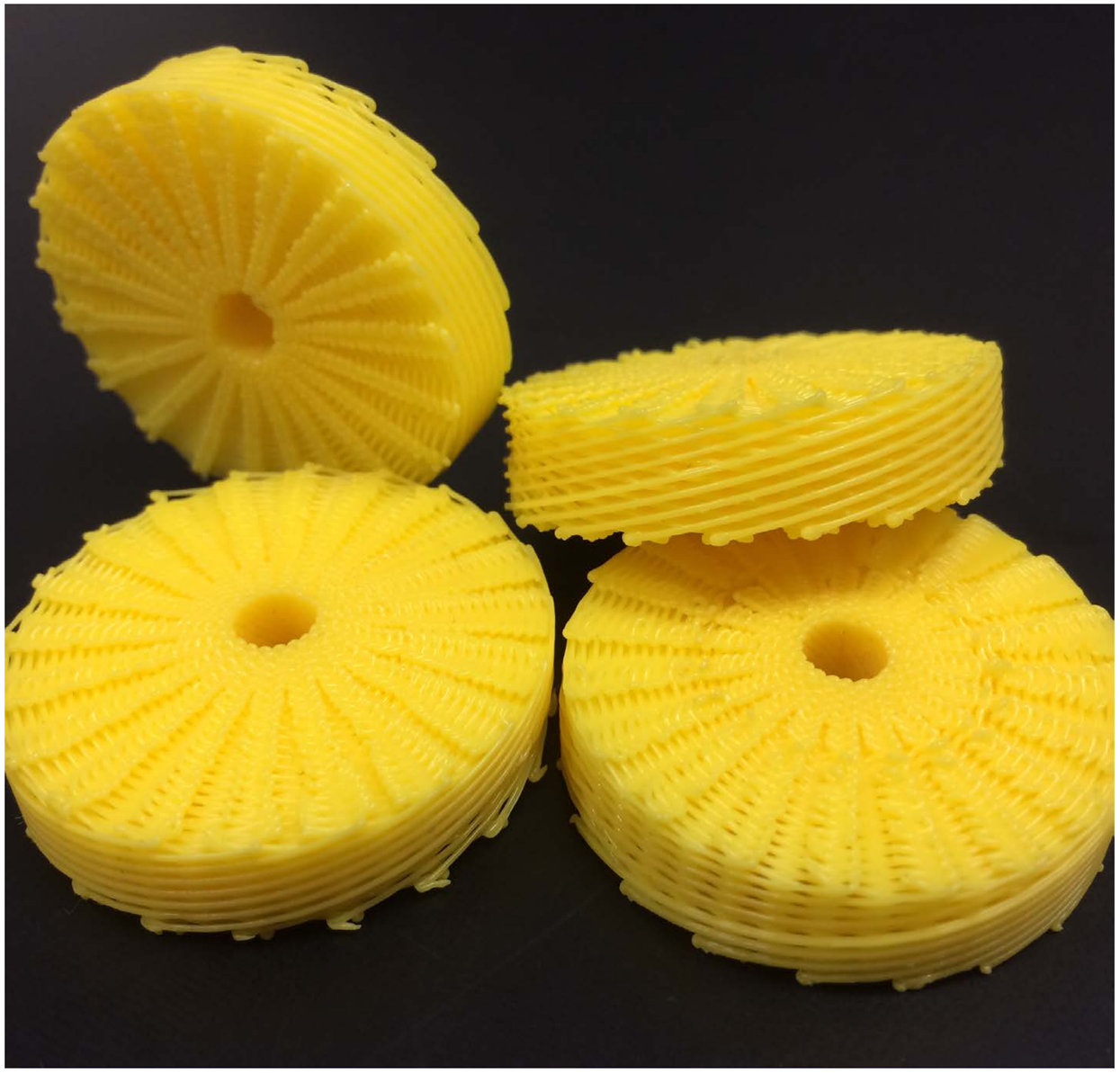
3D Gumball Gallery



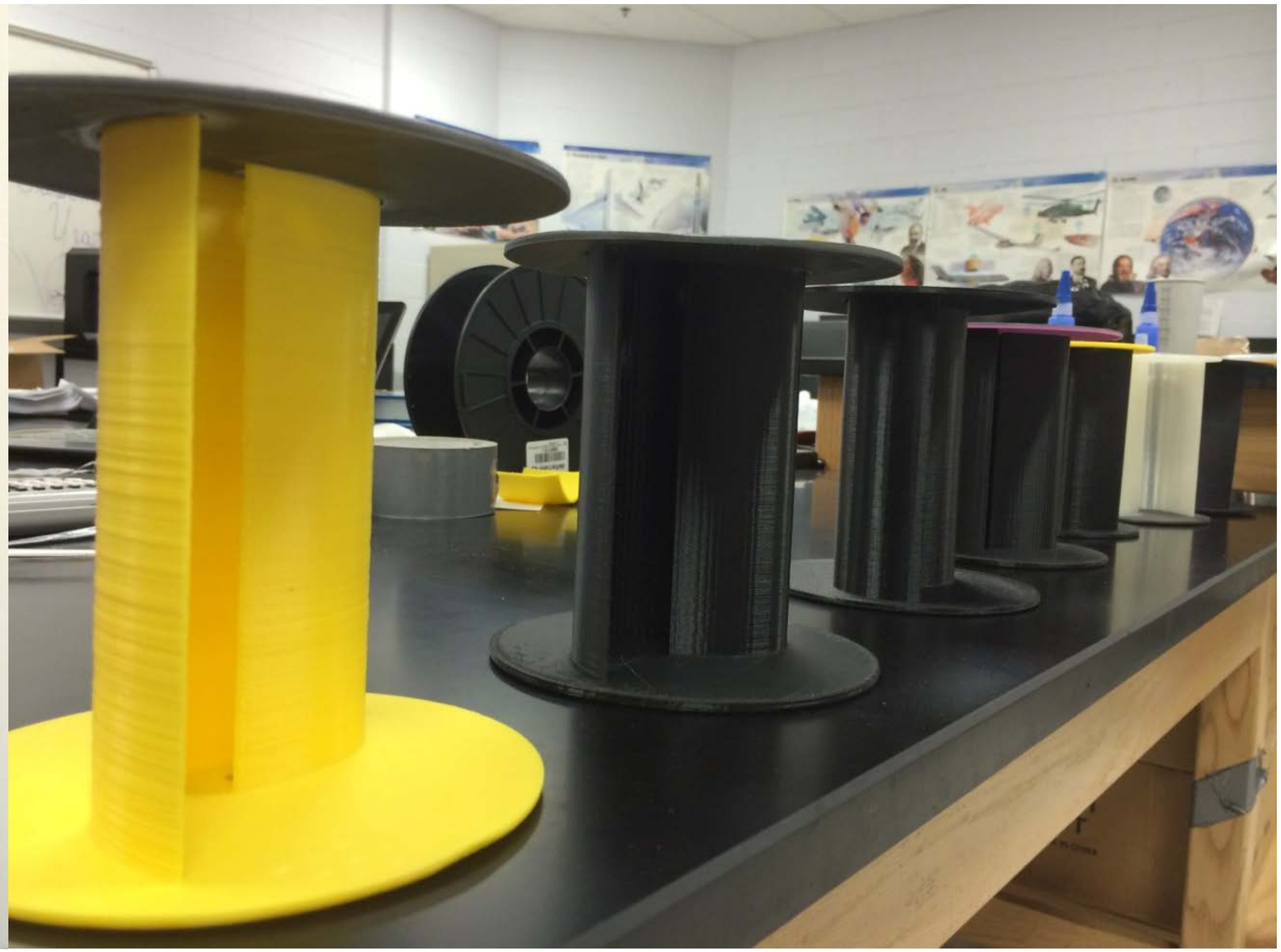
Student models courtesy Wendy Ahart

Spinal Disc Research



High School Research Student

Vertical Wind Turbine



Collaboration with Singapore

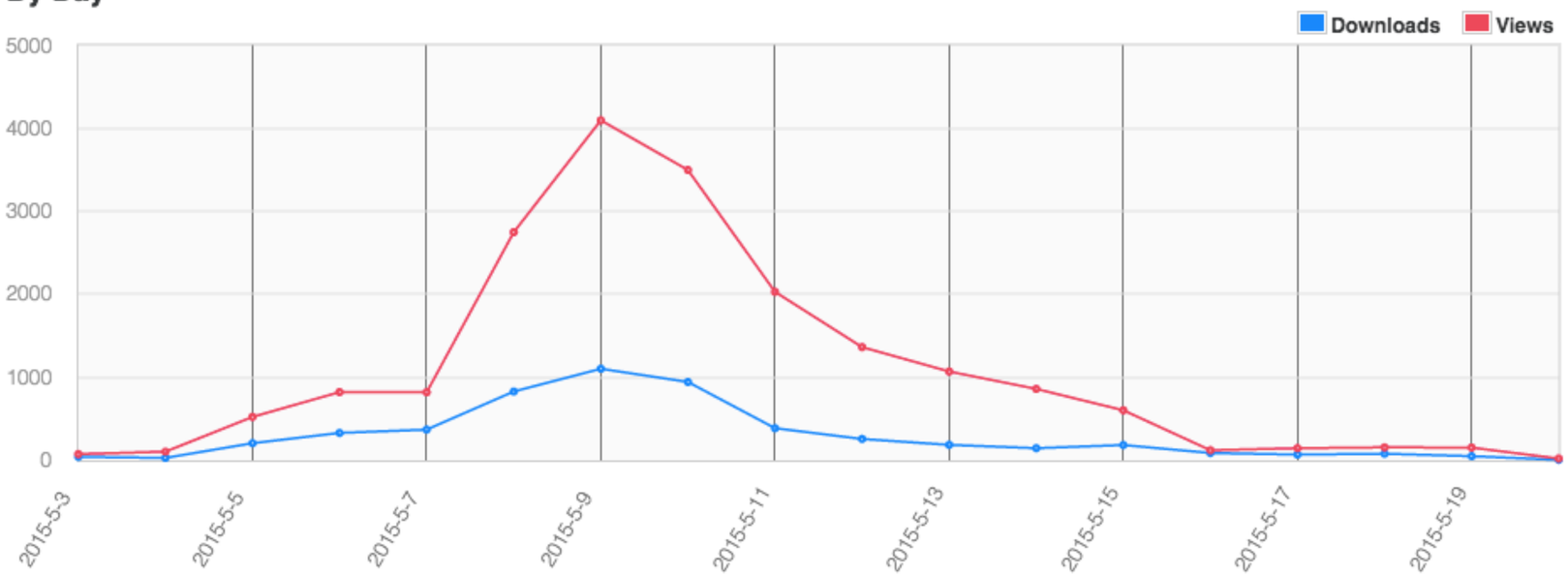
Morphi - IOS

morphiapp.com

Sharing

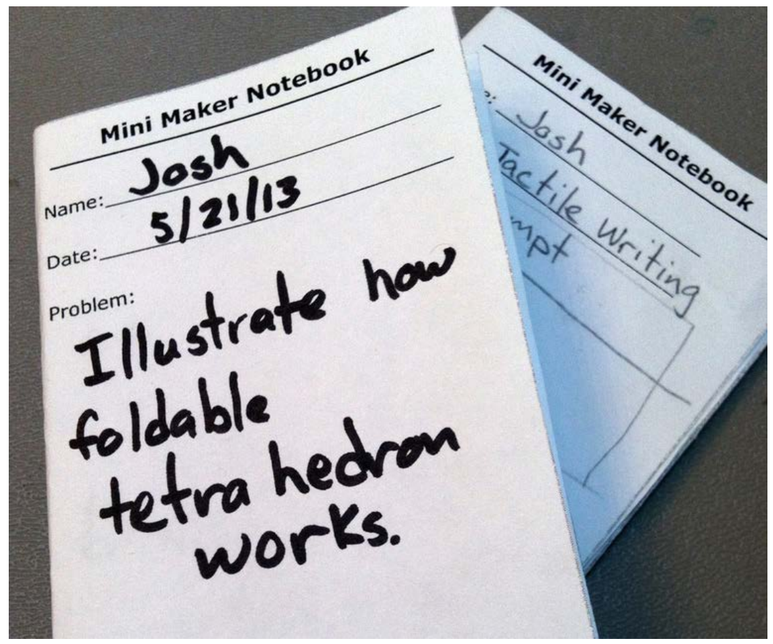
Showing data from **2015-05-03** to **2015-05-19**

By Day



By Thing

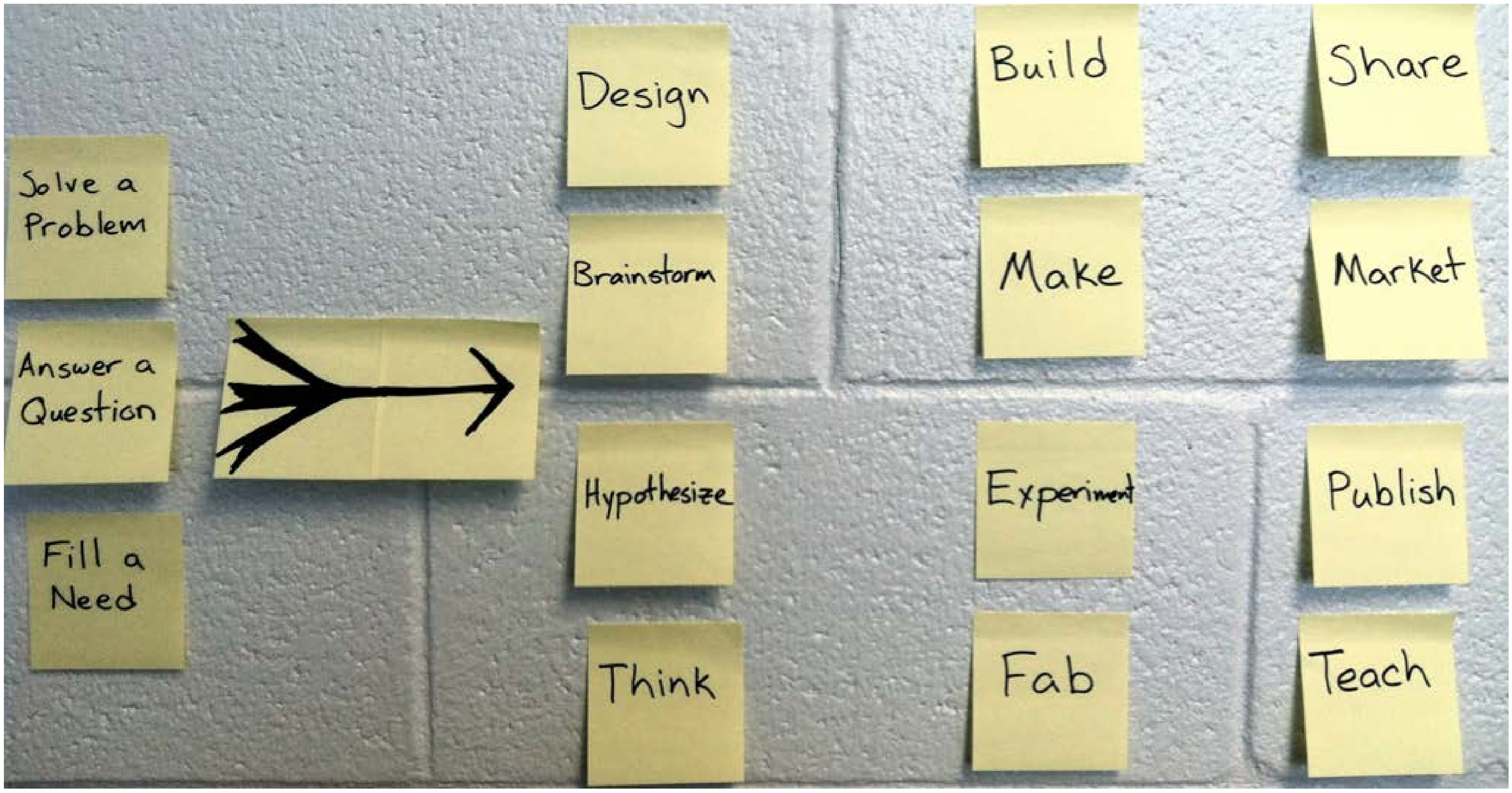
		Views ▼	Downloads	Likes	Collects	Watches	Comments	Makes	Remixes
	MOM Gimbal - Print In Place Published on May 10, 2014	17452 views	4187 downloads	303 likes	345 collects	6 watches	18 comments	30 makes	7 remixes
	MOM Card Published on May 6, 2014	406 views	241 downloads	5 likes	9 collects	0 watches	0 comments	1 makes	0 remixes



http://www.thingiverse.com/thing:93186

Print It Forward - 3D Printer Fundraiser Kit

A Maker Education Model



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