



3D Printing Maker Challenge Unit

Overview: You and your team have been selected by the Dream It Do It Corporation to design the next big thing on the consumer market. Your product will be developed over a 5 week time period. Over this 5 week time period you will compile a product portfolio as well as produce a prototype of your product. This product will be evaluated and judged by an Industry professional.

Goal: Students will learn about the process that takes place when new consumer products are designed from concept to store shelf and put the process to work.

Unit duration: 5 weeks

By the end of this unit, students will be able to:

- Identify items that would be useful in real life situations.
- Create sketches, working drawings, CAD drawings, and a working prototype of a product.
- Invent/Innovate a useful, practical product that can be used by a consumer.
- Estimate sizes, dimensions, strength, usefulness, and market value of a product.

Materials:

- Computers with CAD software, 3D printing slicing software, and internet access.
- 3D printer
- 3D printing filament
- Rulers
- Pencils
- Sketch paper
- Various drawing aids
- 3 ring binder or presentation board for portfolio

Resources:

- <https://www.makerbot.com/stories/education/lesson-plans-steam-learning/Videos>
- <https://www.makersempire.com/10-inspiring-3d-printing-lesson-ideas-created-by-teachers/>
- <https://ultimaker.com/en/resources/21893-lessons-and-tutorials-by-subject>
- <https://educators.brainpop.com/bp-topic/3d-printing/>
- <https://www.learnbylayers.com/>
- See Images at document end.

Criteria or Final Contest Rules:

- In teams of 2-3 students, create a prototype for a useful 3D printed product for a consumer market.
- You are only limited by time and your teams' creativity.
- A long with the 3D printed prototype you will be required to include a project portfolio that includes evidence of the following items:
 - Who needs this? (product research/purpose for design)
 - Why do they need this? (how design fulfills a particular need)
 - Sources of information/evidence of research. (interviews, articles, news, etc.)
 - Complete design sketch that shows the final product, and includes documentation of all revisions to the project.
 - Final drawings created in CAD software, dimensioned.
 - 3D rendered drawing created in CAD software.
- Final product must be able to function as designed to satisfy its purpose.

Timeline:

2 months prior: Planning/budget

1 month prior: Order supplies

2 weeks prior: Designing, revising and printing

1 week prior: Printing

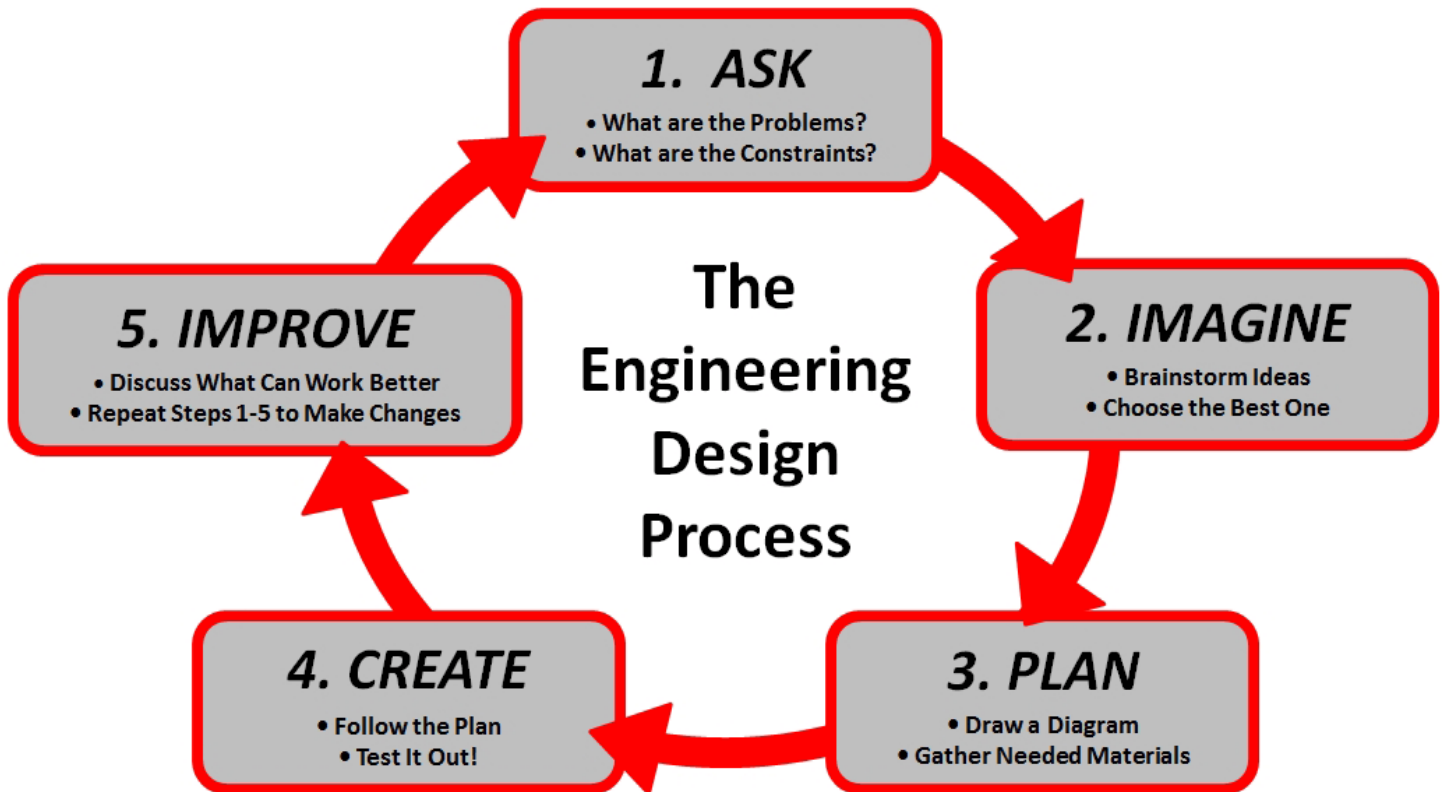
Event held at: Individual school districts. Prototypes and portfolios collected and dropped off to industry professional judging.

Activity Overview

Week	Activity	Activity outline	Guiding questions
1	Introduction, Research and Brainstorming session	<ul style="list-style-type: none"> Students will be introduced to the competition, the rules and what is expected of them. If no prior experience with CAD software or 3D printing an introductory lesson should be given along with an overview of the design process. Use links above for available lessons. Students should also have time available to research possible product ideas and/or brainstorming ideas. 	<p>What is rapid prototyping? What is my market? Who is my customer? What would make my life easier? What is already out there that could be tweaked to work better?</p>
2	Research, Brainstorming and Design	<ul style="list-style-type: none"> Students should be researching and brainstorming in order to satisfy the portfolio requirement. Concept/ design sketching should be getting underway. 	<p>How will my product work? How big should my product be? Will my product be functional and look good?</p>
3	CAD/Printing	<ul style="list-style-type: none"> CAD drawings and renderings should be getting started. Some students may be printing in order to refine designs. 	<p>What dimensions would someone need to make my product? What plane should I start my drawing on? How do I save my drawing in stl. format?</p>
4	CAD/Printing	<ul style="list-style-type: none"> CAD revisions Printing revisions Final prints 	<p>What could I change to make my product look or work better? Do my product function as previously imagined?</p>
5	Printing	<ul style="list-style-type: none"> Final prints Portfolio organization 	

Judging Criteria

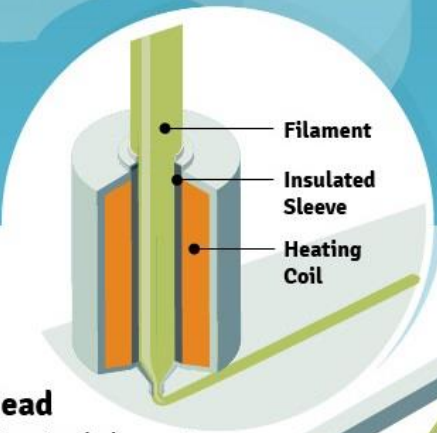
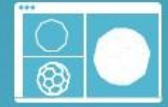
Category	Criteria	Scale	Score
Design	Meets the design criteria (List criteria)	4-5 – Excellent 2-3 – Satisfactory 1 – Unsatisfactory 0 - Missing	
Methodology	Demonstrates intended design (List criteria)	4-5 – Excellent 2-3 – Satisfactory 1 – Unsatisfactory 0 - Missing	
Construction	Craftsmanship Adherence to design (List criteria)	4-5 – Excellent 2-3 – Satisfactory 1 – Unsatisfactory 0 - Missing	
Creativity	Shows creativity and innovation (List criteria)	4-5 – Excellent 2-3 – Satisfactory 1 – Unsatisfactory 0 - Missing	
Presentation	Clear and professional Thoughtful responses to questions Poster – clarity and aesthetics (List criteria)	4-5 – Excellent 2-3 – Satisfactory 1 – Unsatisfactory 0 – Missing	
		Total	



THE BASICS OF PRINTING IN 3D

How it works:

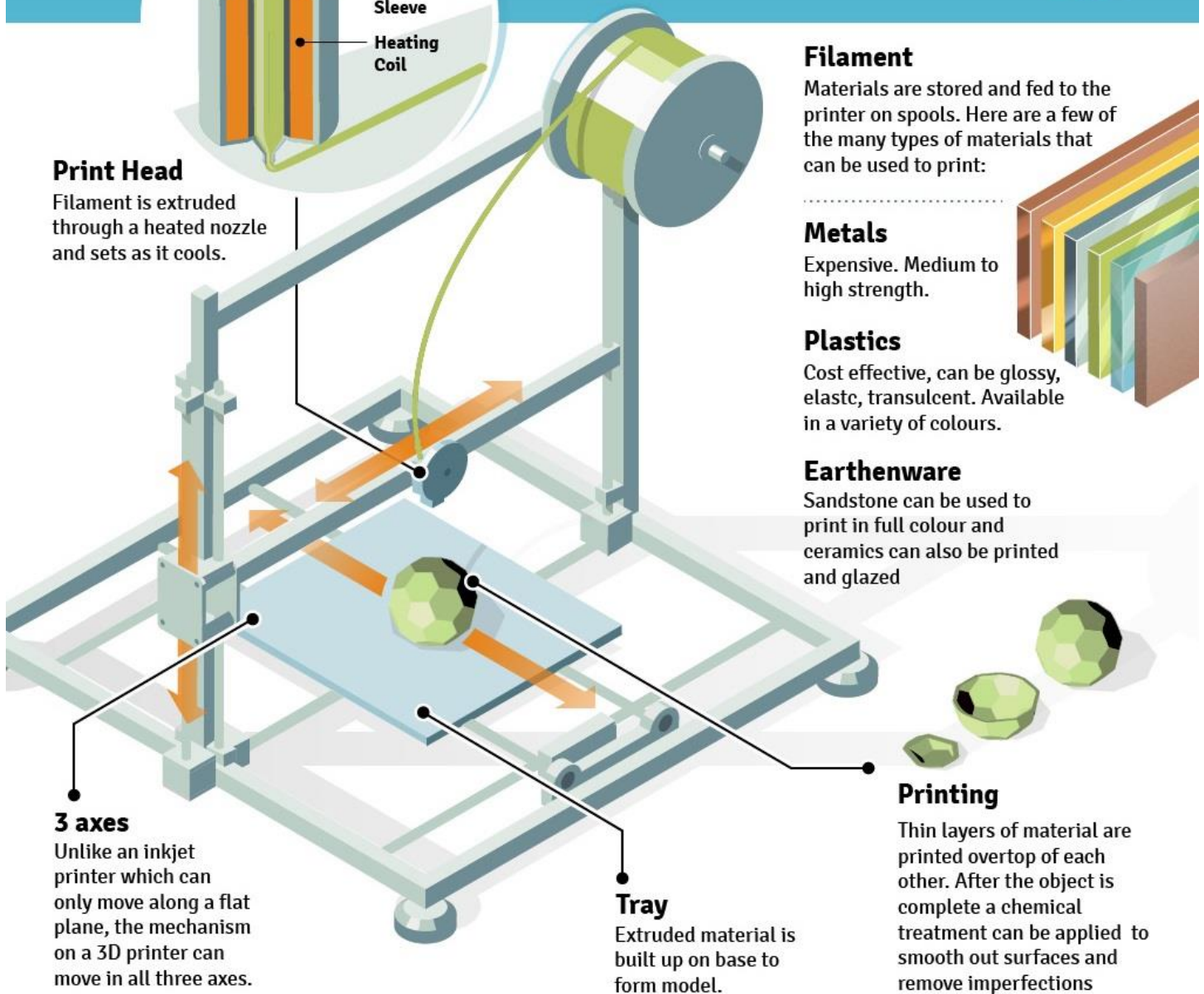
- 1 Plans are drawn in CAD applications and then passed to printer-specific software that allows materials to be specified, scale to be set, etc.
- 2 Instructions can be passed to a 3D printer connected to your PC or sent to one of many online services for printing.
- 3 Depending on the size and complexity of the object, minutes or hours later the object is ready.



Filament
Insulated Sleeve
Heating Coil

Print Head

Filament is extruded through a heated nozzle and sets as it cools.



3 axes

Unlike an inkjet printer which can only move along a flat plane, the mechanism on a 3D printer can move in all three axes.

Tray

Extruded material is built up on base to form model.

Filament

Materials are stored and fed to the printer on spools. Here are a few of the many types of materials that can be used to print:

Metals

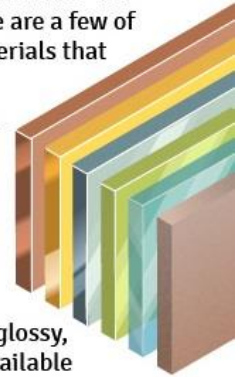
Expensive. Medium to high strength.

Plastics

Cost effective, can be glossy, elastic, translucent. Available in a variety of colours.

Earthenware

Sandstone can be used to print in full colour and ceramics can also be printed and glazed



Printing

Thin layers of material are printed overtop of each other. After the object is complete a chemical treatment can be applied to smooth out surfaces and remove imperfections