GERI SUMMER 2015

Toy Design in Mechanical Engineering

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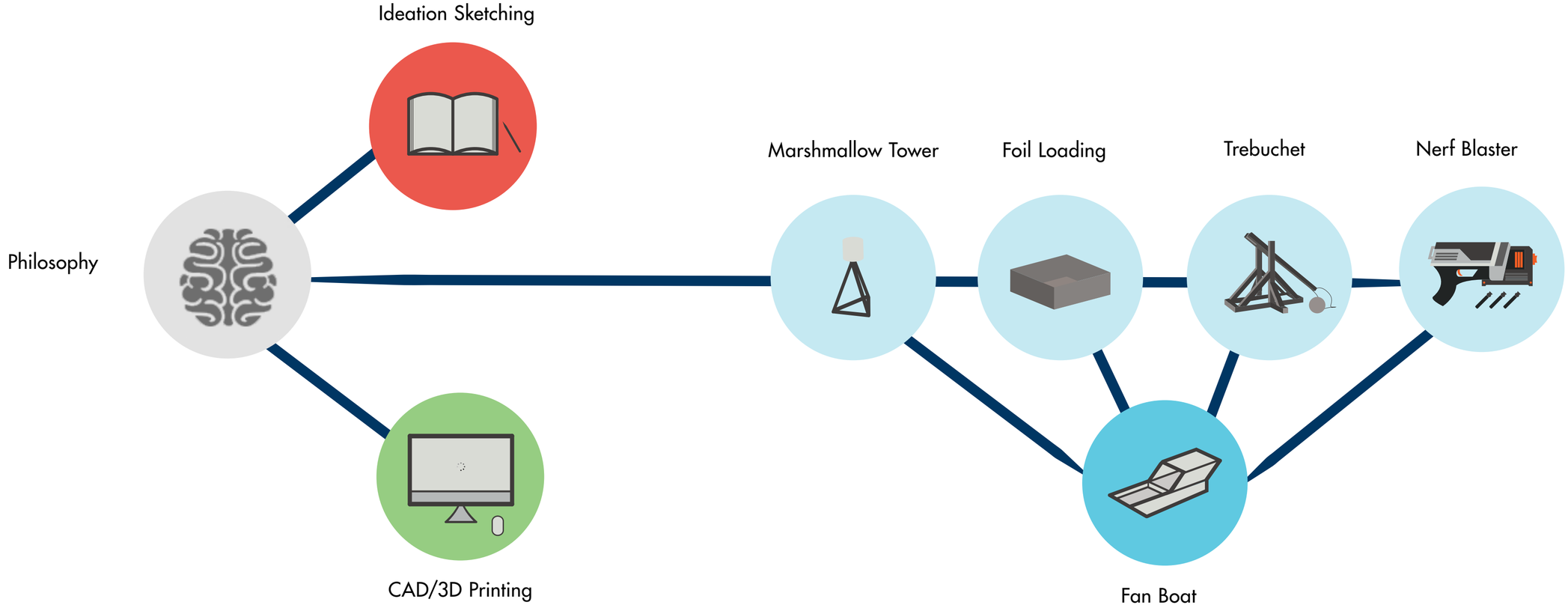
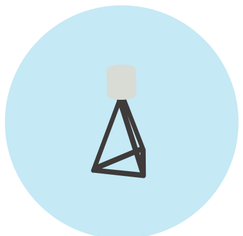


OUR PHILOSOPHY

We want children to learn through experience. They need to prototype to think instead of solely relying on equations. Authentic learning is the method we use so that students can learn in a way that connects to their lives and provides a strong foundation in creativity.



ACTIVITY: MARSHMALLOW TOWER

Students have 18 minutes to create the highest freestanding spaghetti tower that can also hold the weight of a marshmallow.

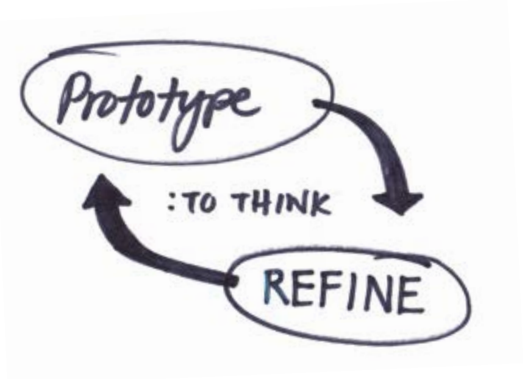
Materials:

- 20 sticks of spaghetti
- 1 yard of masking tape
- 1 yard of string
- 1 marshmallow

Key Concepts:

- Prototype early and often.
- Shape strengths, triangle's are strongest.
- Bending, tension, compression

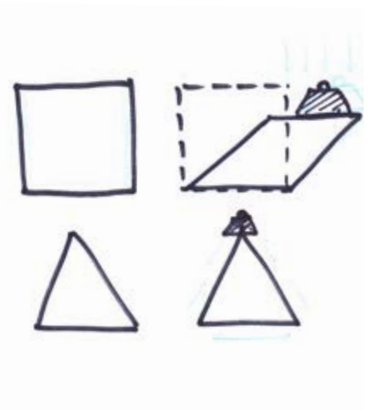
CONCEPTS

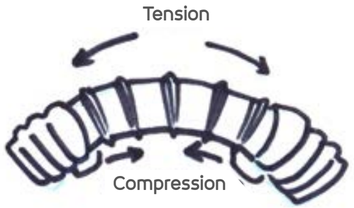


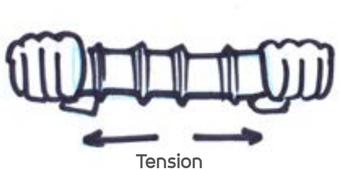
Evaluate

Build / Refine
(Prototype)

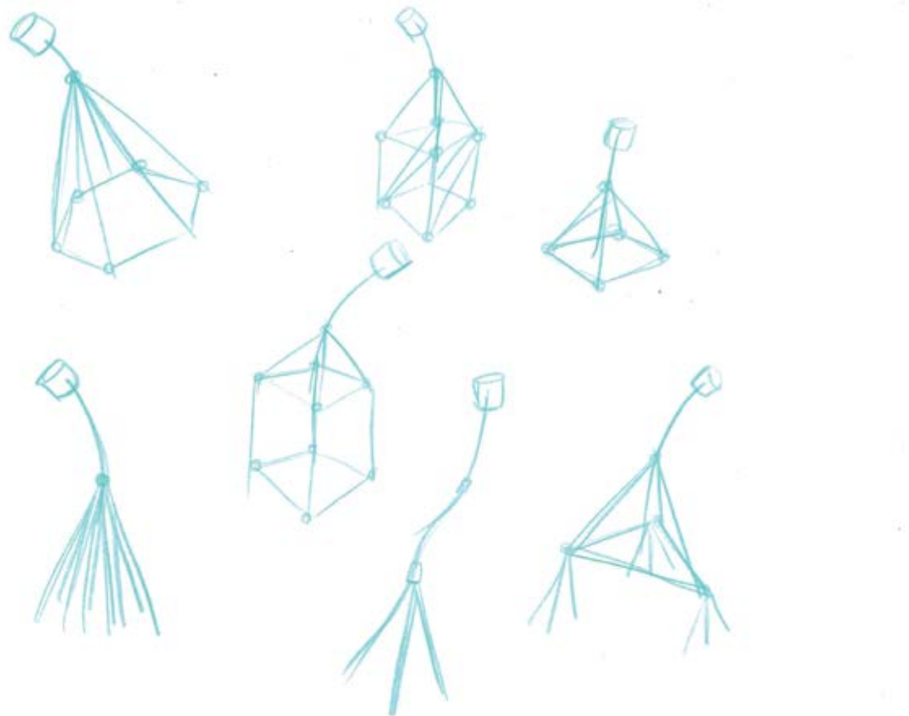
FInal







SKETCHING / PROTOTYPING

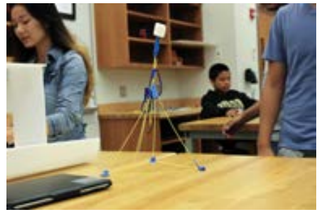
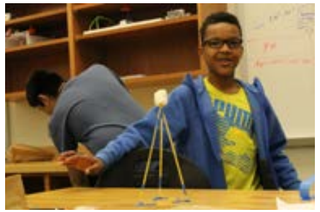


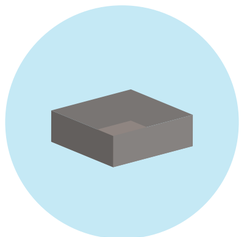
"Some of the challenges I faced today when building the marshamllow tower was building a strong base. I solved it by making triangles"

- Shankor

CONCLUSION



ACTIVITY: FOIL LOADING

Students will create aluminum foil vessels to be loaded with coins. There are 2 stages, in the first stage the goal is to hold the as many nickels as possible. The goal of the second stage will be to hold 50 pennies with as little aluminum foil as possible.

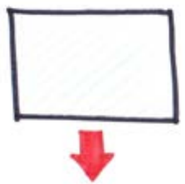
Materials:

- 6x6 in piece of aluminum foil
- Coins; pennies & nickels

Key Concepts:

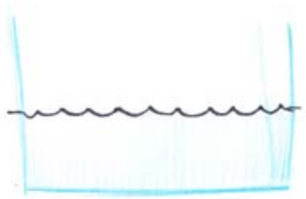
- Prototyping
- Weight distribution
- Buoyancy

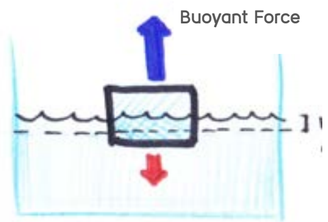
CONCEPTS



Force due
to gravity

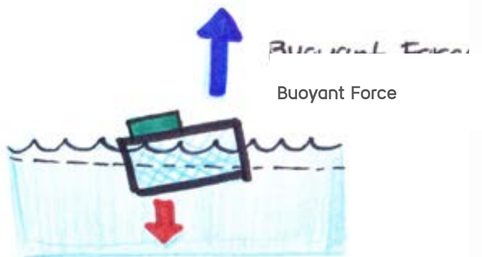
Buoyancy:



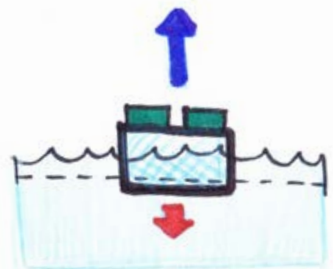


Height difference
between water
is equal to the
water displaced.

Weight Distribution:

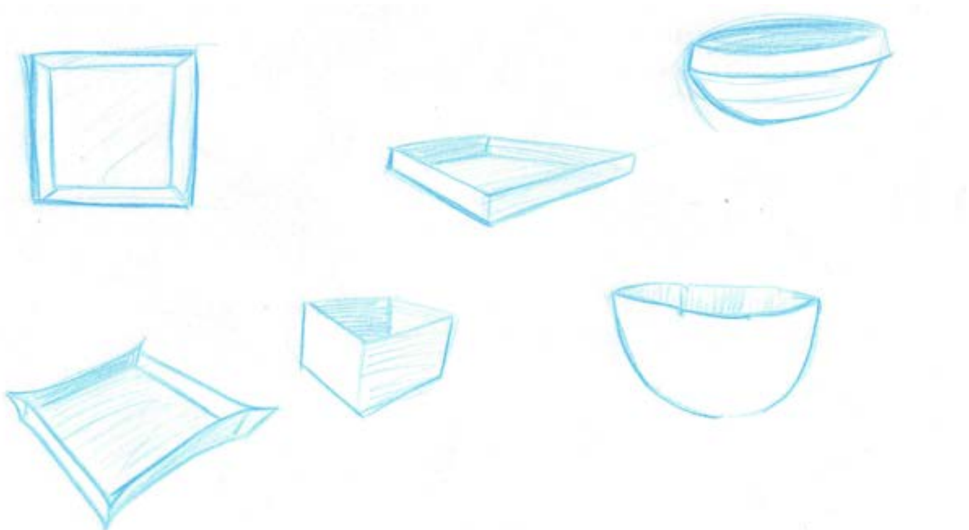


Force is stronger on
one side of the object.

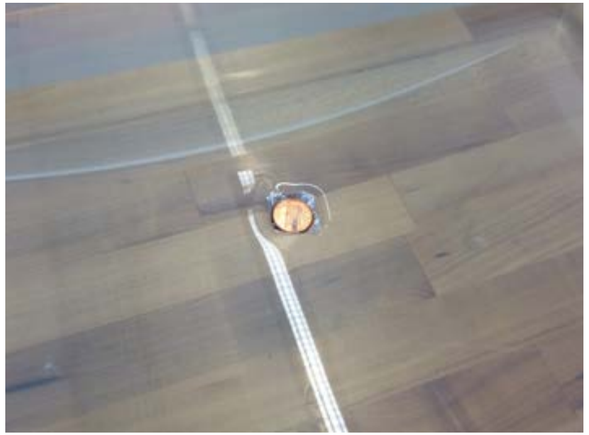


Force is evenly
distributed.

PROTOTYPING / TESTING



FINAL



ACTIVITY: IDEATION SKETCHING

Students learn techniques for efficient sketching.The class ends with an activity that pushes students to create as many concepts for a product as possible within a set amount of time.

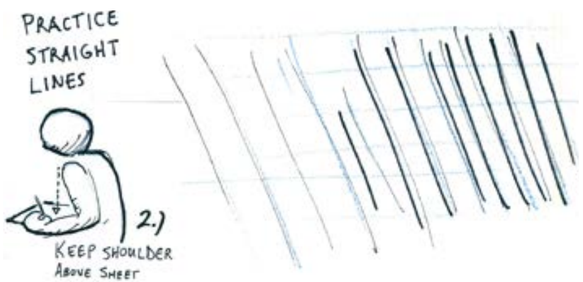
Materials:

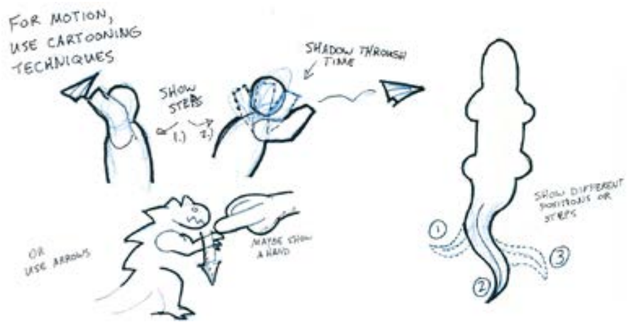
- Blue water color pencil
- Sharpie, Colored markers
- Paper

Key Concepts:

- Sketching for concept generation
- Annotating
- Sketching as a form of thinking
- Conveying motion

CONCEPTS


PRACTICE STRAIGHT LINES
2.)
KEEP SHOULDER ABOVE SHEET


FOR MOTION, USE CARTOONING TECHNIQUES
SHOW STEPS
1.)
2.)
SHADOW THROUGH TIME
OR USE ARROWS
MAYBE SHOW A HAND
SHOW DIFFERENT POSITIONS OR STEPS
1
2
3


3.)
BE EXPRESSIVE


4.)
DON'T WORRY TOO MUCH ABOUT PERSPECTIVE- ORTHO VIEWS ARE EASIEST


GIVING SCALE/CONTEXT
HUMAN BODY GOOD FOR GIVING A SENSE OF SCALE
HUMANOID
HEAD
show eyeline
ARM
BODY
NO HAND
NO LEGS
AVERAGE HUMAN HEIGHT ~ 8.5 HEADS HIGH


ROUGH HAND
FINGERS OPTIONAL
VERY ROUGH HAND
FOREARM OPTIONAL
IF YOU NEED MORE DETAIL ON HAND, USE YOUR OTHER HAND AS A MODEL
E.G.

WARM UPS / TECHNIQUES

Students start with a couple of warm up activites to get them comfortable with the sketching tools provided.

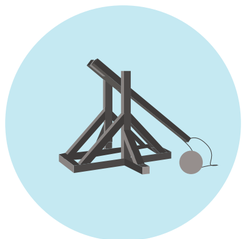






We ended the day by giving students an activity that pushed them to use all the tools and techniques learned to create 5 ideas in 5 minutes.





ACTIVITY: TREBUCHET

Students will have 105 minutes to create trebuchets that will utilize a weight to throw a tennis ball as far as possible. The students will be prompted to make predictions and to think about concepts such as the transfer of energy from potential gravitational to kinetic through mechanical advantage in the physical sense, rather than strictly theoretical.

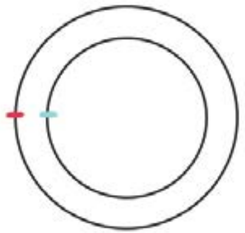
Materials:

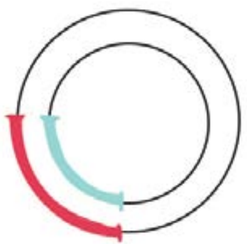
- 15 ft PVC pipe
- 6 elbow connectors
- 2 T-connectors
- 1 cross-connector
- 6 ft of string
- 1 large paper clip
- 1 quart sized bag
- 1 dowel rod (4ft long, ¼" thick)
- 5 ft of duct tape

Key Concepts:

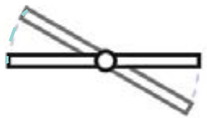
- Planning
- Prototyping
- Momentum
- Angular velocity
- Energy transfer
- Torque

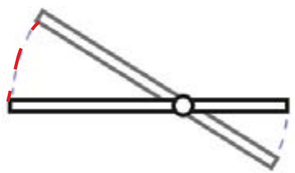
CONCEPTS



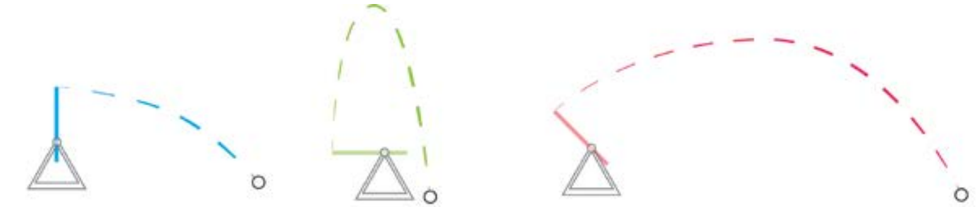


The red line has to travel faster than the blue line to stay aligned.





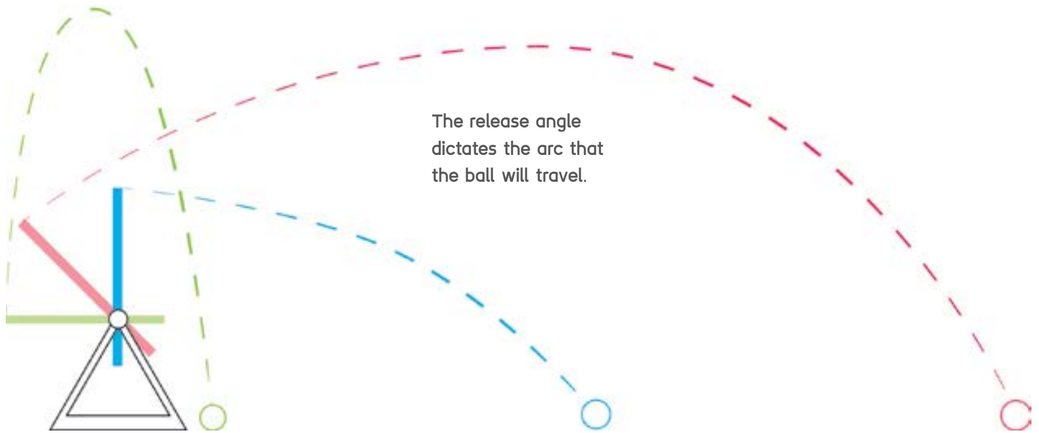
The longer the arm on one side, the more distance is traveled.



90 degree

0 degree

45 degree



The release angle dictates the arc that the ball will travel.

SKETCHING / PROTOTYPING






"I talked with other people and drew some sketches for planning and I stuck to that when I came across problems."
-Walter

"When something is broken, try building it in another way instead of the same way"
- ?






FINAL






ACTIVITY: NERF BLASTER

Students will spend one class day dissecting a Nerf blaster and learning how it works.

Materials:

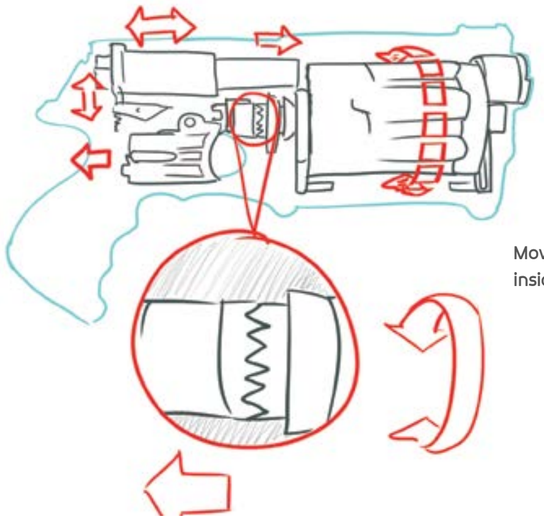
- Nerf Blasters
- Screwdrivers

Key Concepts:

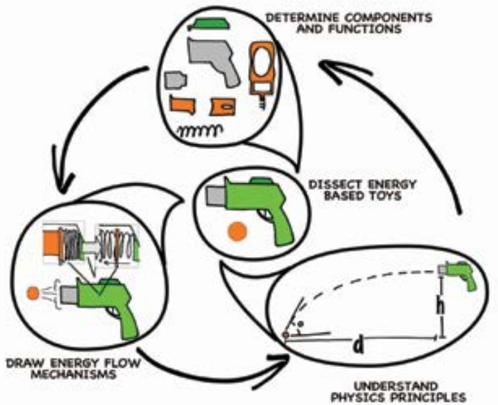
- Energy transfer
- Mechanical linkages
- Sequences
- Impulse
- Simple outside, complex inside

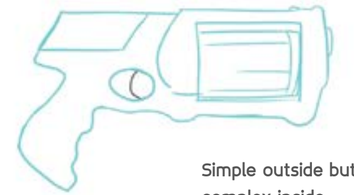
CONCEPTS

The order that these mechanical links hit each other is important.

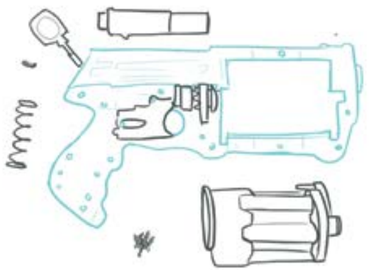


Movement of the parts inside the Nerf blaster.





Simple outside but complex inside.

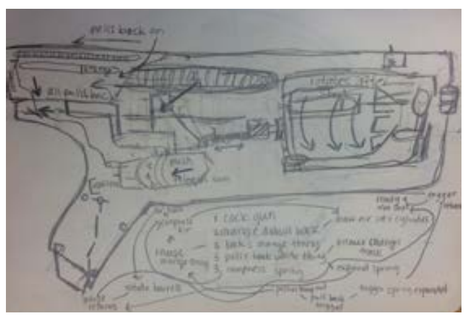


DISSECTION / ANALYSIS







ACTIVITY: COMPUTER AIDED DESIGN / 3D PRINTING

Students spend two days working in a computer lab learning how to use a computer aided design program, which they then use to create a small toy that will then be 3D printed.

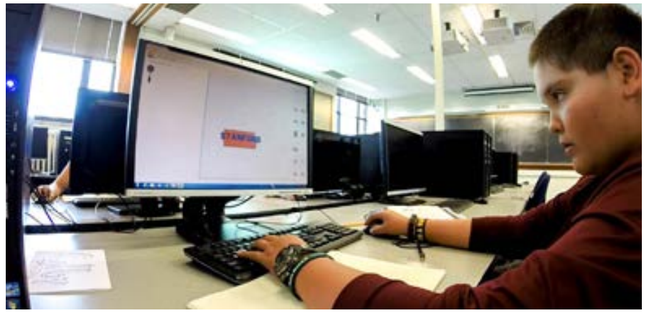
Materials:

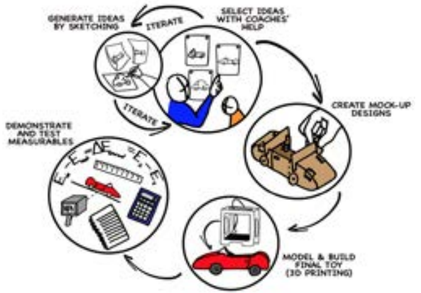
- Autocad program
- 3d printer

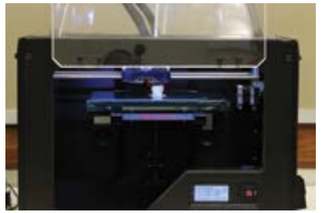
Key Concepts:

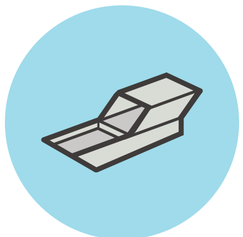
- Prototyping
- Knowledge about 3D printing

MODELING / PRINTING









ACTIVITY: FAN BOAT

Students spend the last three days of the session working on their fan boats. These boats need to be controlled by a remote and be able to accelerate and manuever through an obstacle course.

Materials:

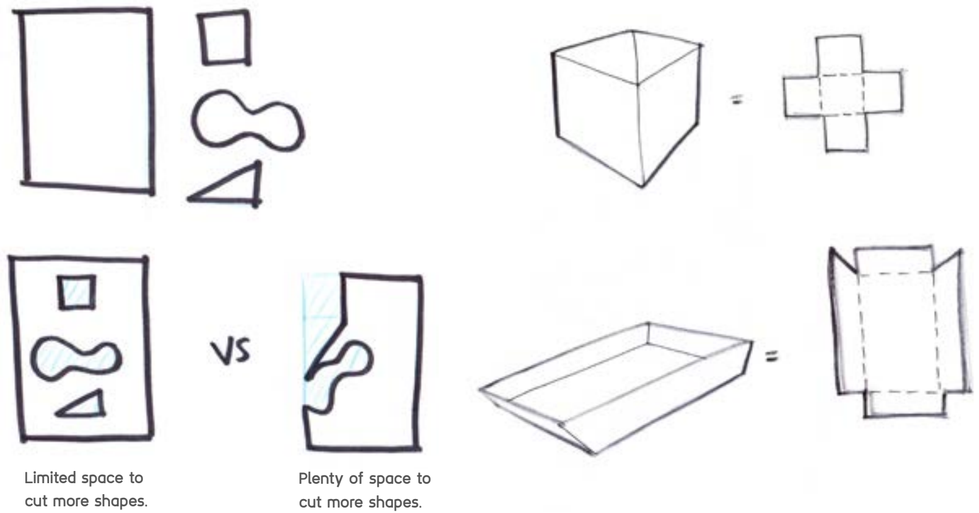
- Foam board
- Arts & crafts supplies
- Propeller
- Motor
- Controller
- Receiver
- Servo
- Laser cut control horns

Key Concepts:

- Planning
- Prototyping
- Weight distribution
- Shape strength
- Energy transfer
- Impulse
- Momentum

CONCEPTS

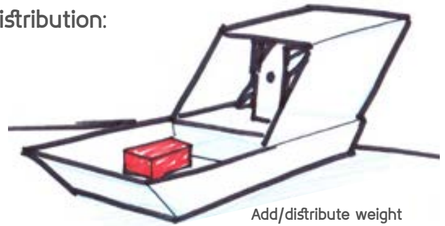
Planning:



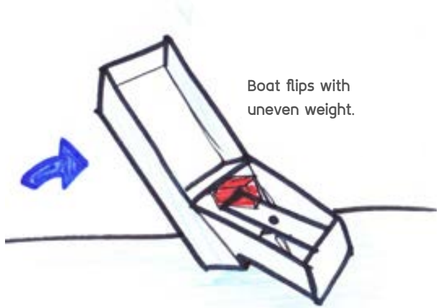
Limited space to cut more shapes.

Plenty of space to cut more shapes.

Weight Distribution:



Add/distribute weight through out boat.



Boat flips with uneven weight.

SKETCHING / PROTOTYPING





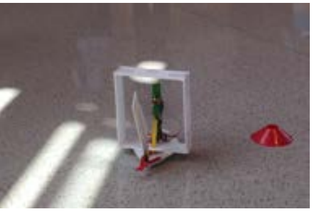

"Sometimes (the task) is more difficult than I thought, so I failed. I then tried to doing it many different ways then got the best one."
- Jerry








TESTING / FINAL





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