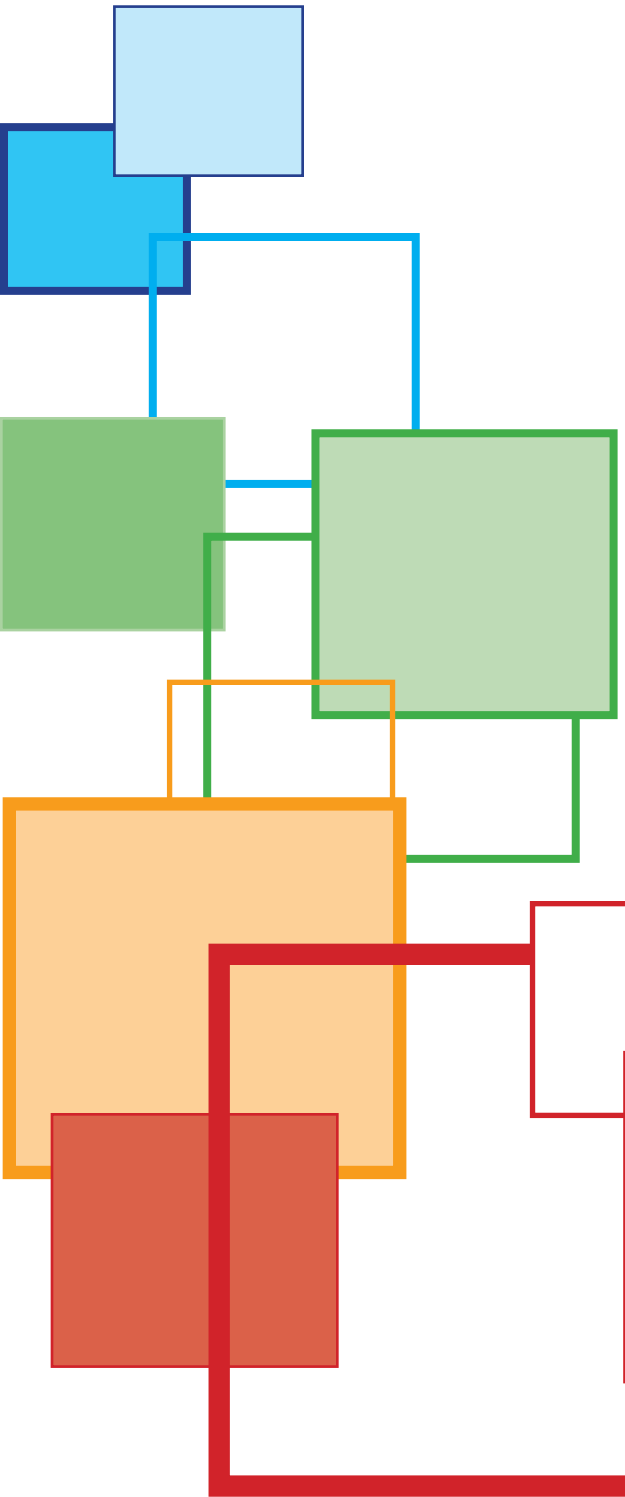


GERI SUMMER 2016

Toy Design in Mechanical Engineering

OVERVIEW

Product Design is an iterative and highly structured process that utilizes applications of Science, Technology, Engineering and Mathematics (STEM). At our Toy Design Workshop we introduce children to an iterative, engineering design process that inspires them to imagine, ideate, iterate, and implement their thoughts to physical prototypes. Through various toy design activities we create a fun and engaging environment that allows children to play and develop their personalized toys, all the while developing a deeper understanding of different STEM concepts. Here, children surprise us each day with their creativity and their ability to transfer different physics and design concepts to real world applications. We hope you see through this book what we see from running the workshop. We hope our workshops pave way for more engaging and educational programs that attract young learners from around the world to become better designers and makers of things.

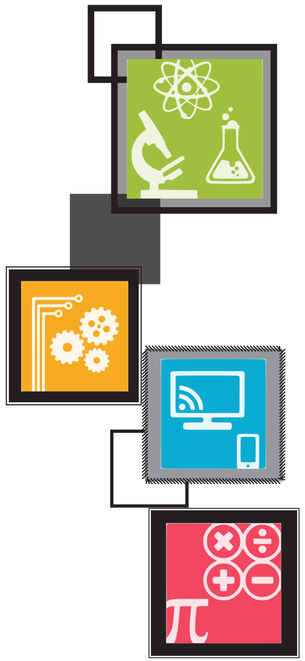
TABLE OF CONTENTS

Source: http://www.somerandomblog.com/wp-content/uploads/2017/01/ziro.png

OUR PHILOSOPHY: PROTOTYPE TO THINK

We want children to learn by designing, building and testing in authentic situations that connect to their lives and provides a strong foundation in creativity. Make them learn through experience.

MOTIVATION



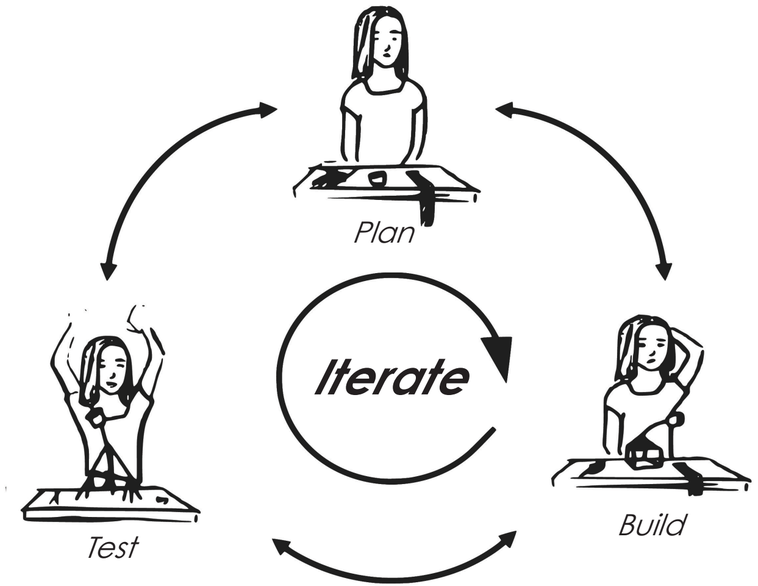
Correlate STEM learning & Real world applications

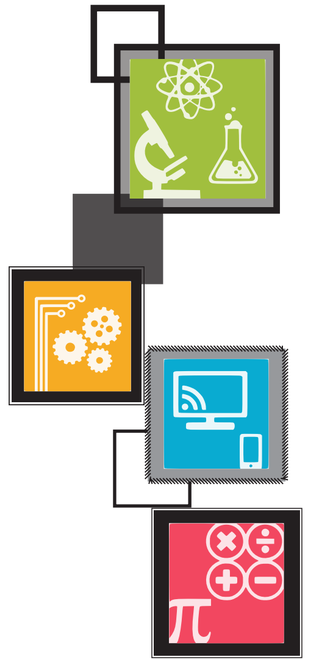
Experiment with the concepts learned in school

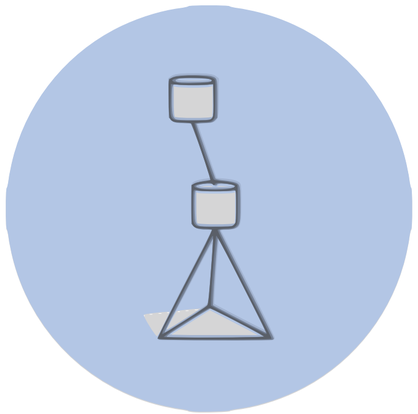
3 areas of Science Learning

> *Scientific & Engineering practices*
> *Corsscutting concepts*
> *Disciplinary core ideas*

Process





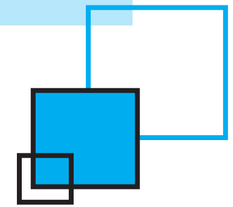


ACTIVITY: *MARSHMALLOW TOWER*

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

Materials:

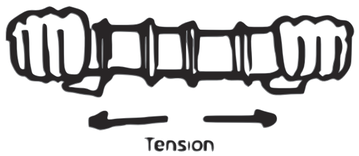
- 20 sticks of spaghetti
- 1 yard of masking tape
- 1 yard of string
- 1 marshmallow

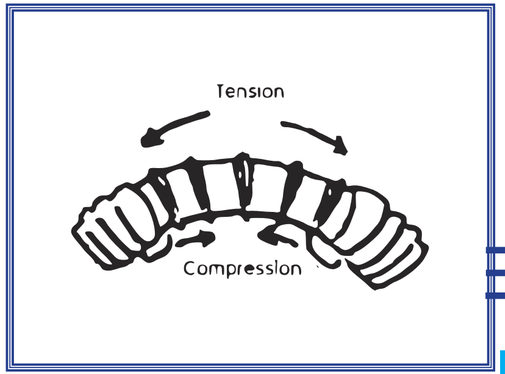


Key Concepts:

- Prototype early and often,
- Strength of shapes: *Triangle's are strongest*
- Bending, tension, compression

Concepts





Source: https://upload.wikimedia.org/wikipedia/commons/d/d8/Eiffel_Tower_Day_Sept._2005_%2810%29.jpg
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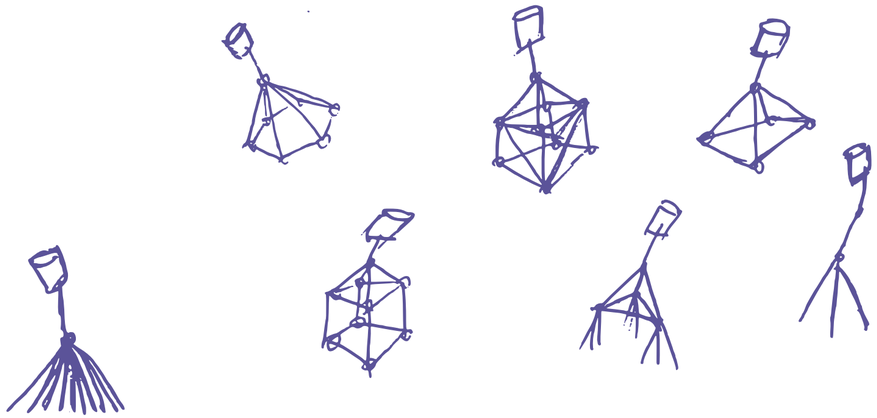
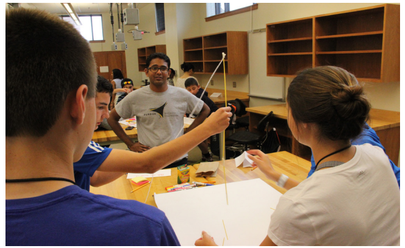
SKETCHING/ PROTOTYPING



"When working on a project, take your time and make sure everything goes smoothly."

- Cole

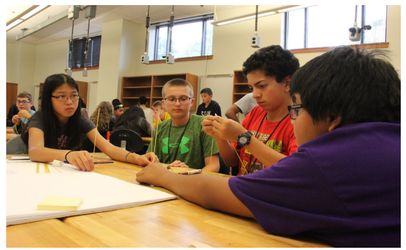


"Your tower need to be stable if you want to achieve your goal."

- Anna

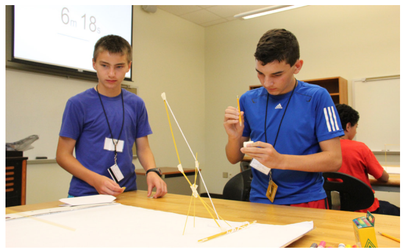
"Sometimes things don't work out and its our job to figure out how to make it work!"

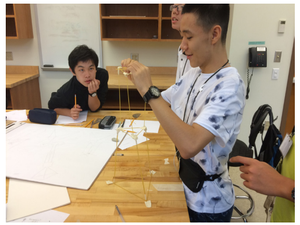
- Shane

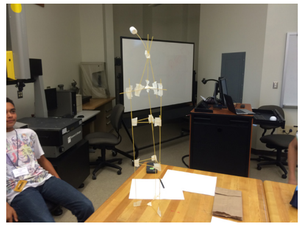


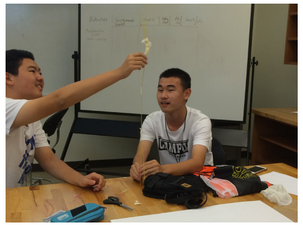
"When we meet some trouble we should think how we can deal with it but not afraid of it. Afraid don't work."

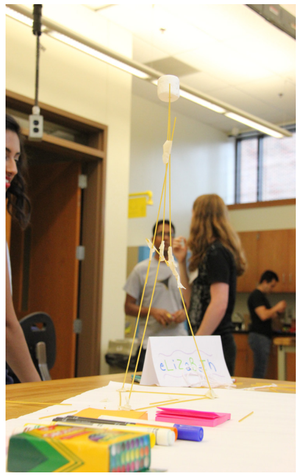
- Linda

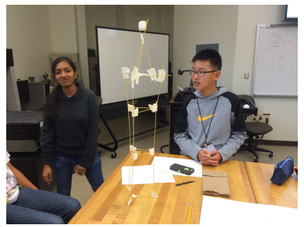


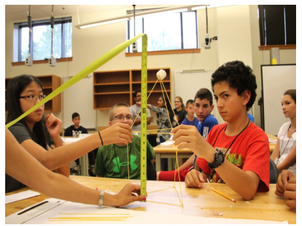




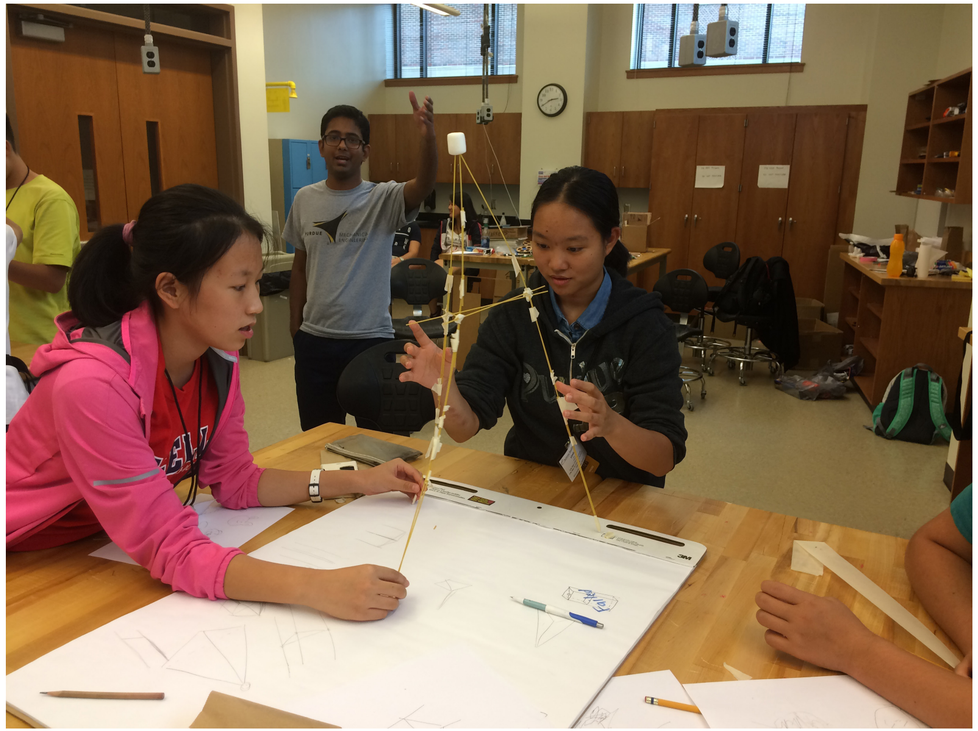








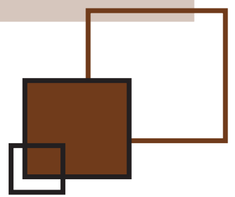
FINAL PROTOTYPES



ACTIVITY: *IDEATION SKETCHING*

Students are introduced to techniques for efficient sketching. The session 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



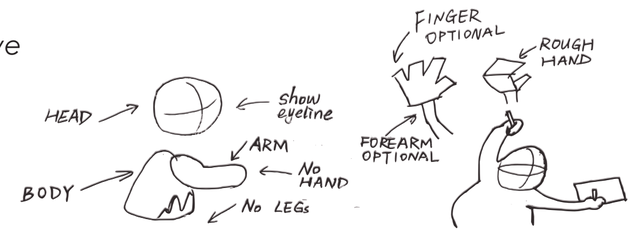
Key Concepts:
- Sketching for concept generation,
- Annotating,
- Sketching as a form of thinking,
- Conveying motion

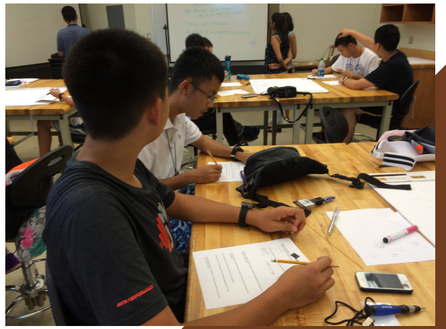
Concepts

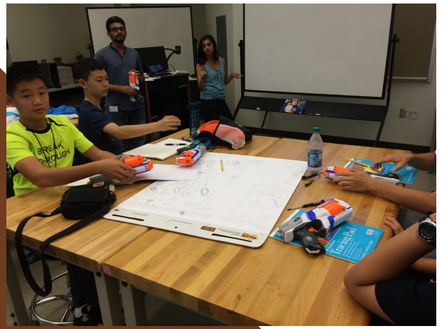
> For motion: use cartooning techniques.

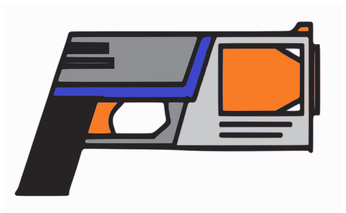
> Don't worry too much about perspective - ortho views are easiest.

> Human body is good for giving a sense of scale.









ACTIVITY: *NERF BLASTER*

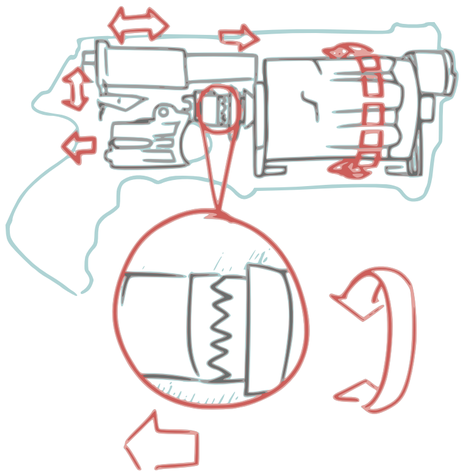
Students spend this session reverse engineering a nerf blaster and learning how it works.

Materials:
- Nerf Blasters
- Screwdrivers

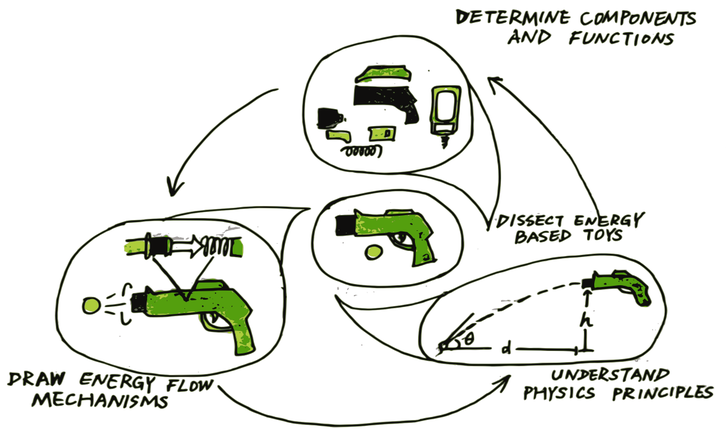
Key Concepts:
- Energy transfer, Impulse,
- Mechanical linkages, Sequences,
- Simple outside, complex inside

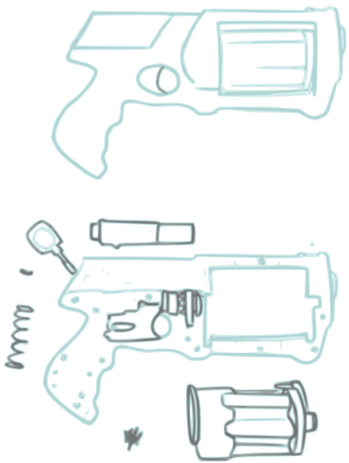
Concepts

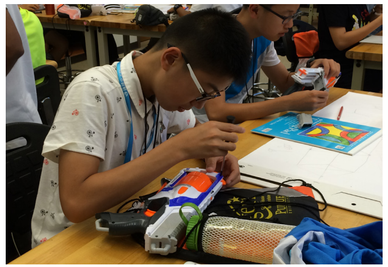
The order that these mechanical links hit each other is important.

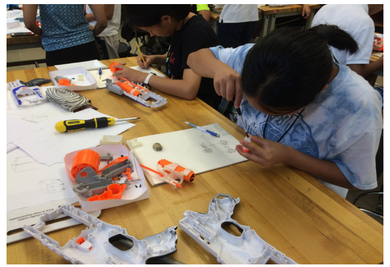
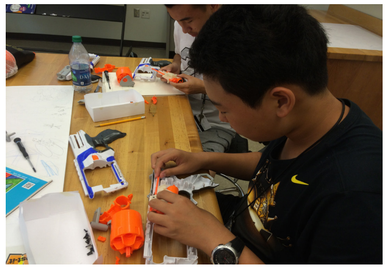


Moverment of the parts inside the Nerf blaster.

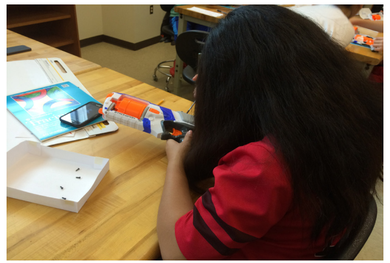


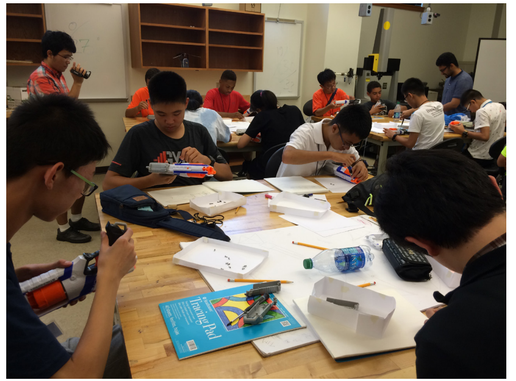




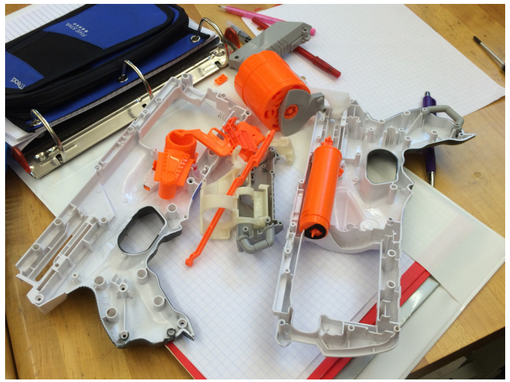
REVERSE ENGINEERING

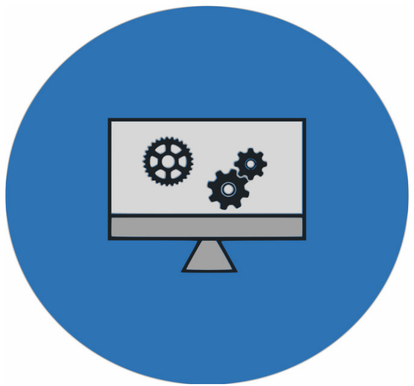


“Never lose any spring or screw, and take a sketch before unravel it then have fun!” *- Jerry*

“Compressed air and mechanisms can do amazing things!” *- Douglas*

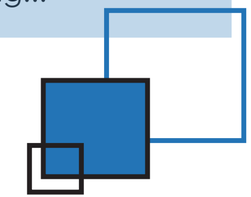





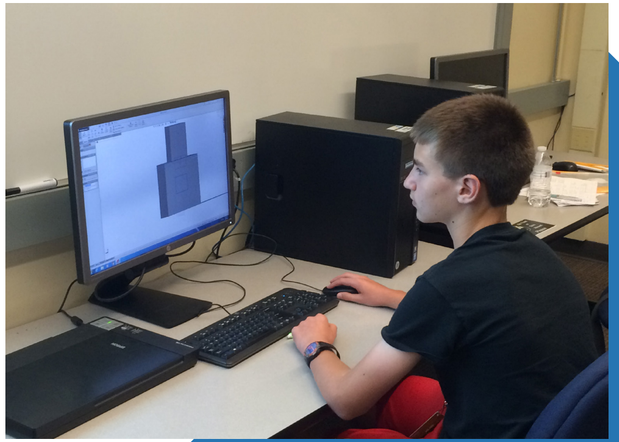
ACTIVITY: *COMPUTER AIDED DESIGN/ 3D PRINTING*

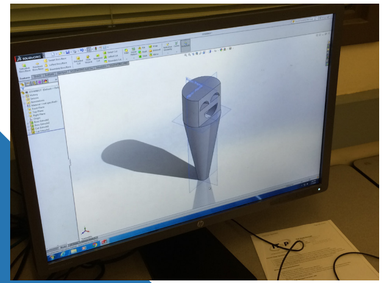
Students are introduced to Computer - Aided - Design to transition ideas from conceptual phase to detailed models which is fabricable using 3D printing or laser cutting...

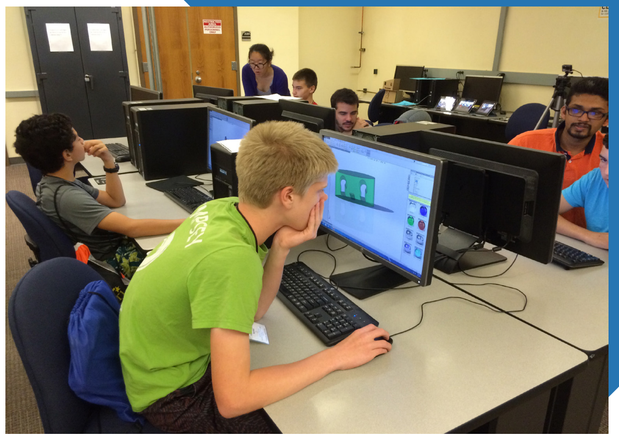
Materials:
- SOLIDWORKS
- 3D printer
- Laser Cutter

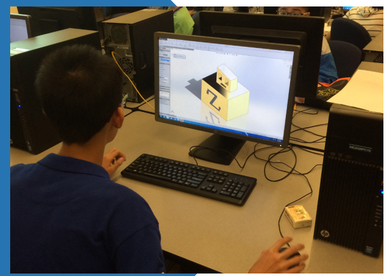


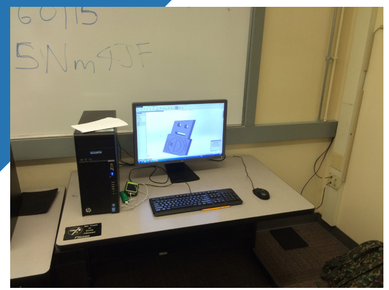
Key Concepts:
- Prototyping, 3D printing
- Laser cutting

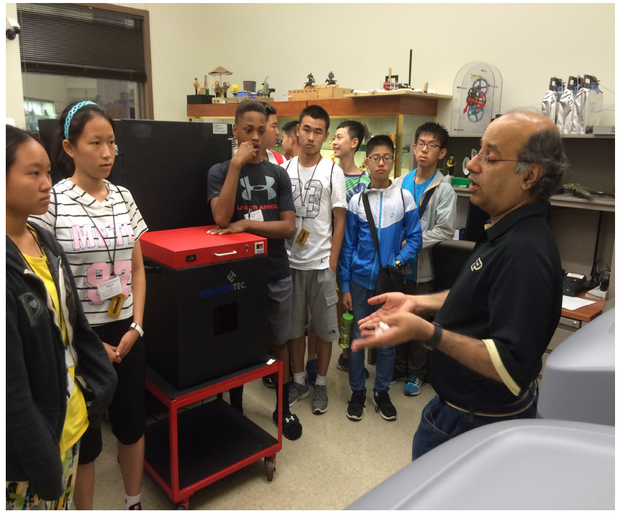












MODELING & PRINTING

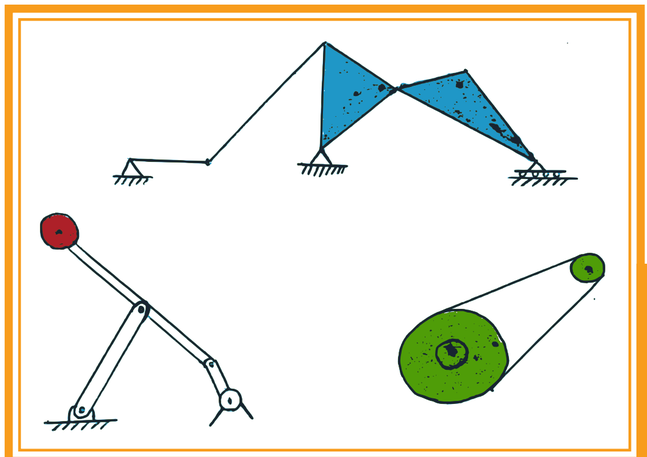
ACTIVITY: *AUTOMATA AND MECHANISMS*

Students learn basic mechanisms and automatas for toy design. This session ends with creative functional toys made by students.

Materials:
- Paper
- Tape
- Color peocil
- Colored markers
- Ziro Modules

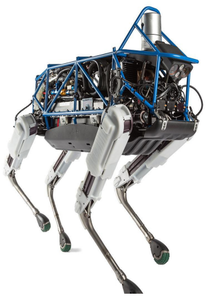
Key Concepts:
- Prototyping
- mechanisms
- Automation through Ziro

Concepts



Mechanisms

Automata



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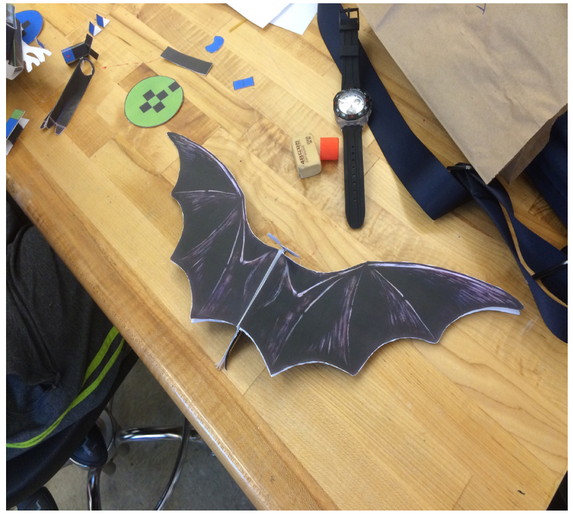
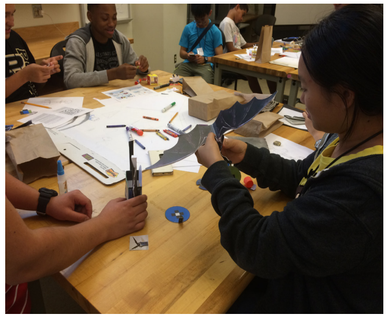
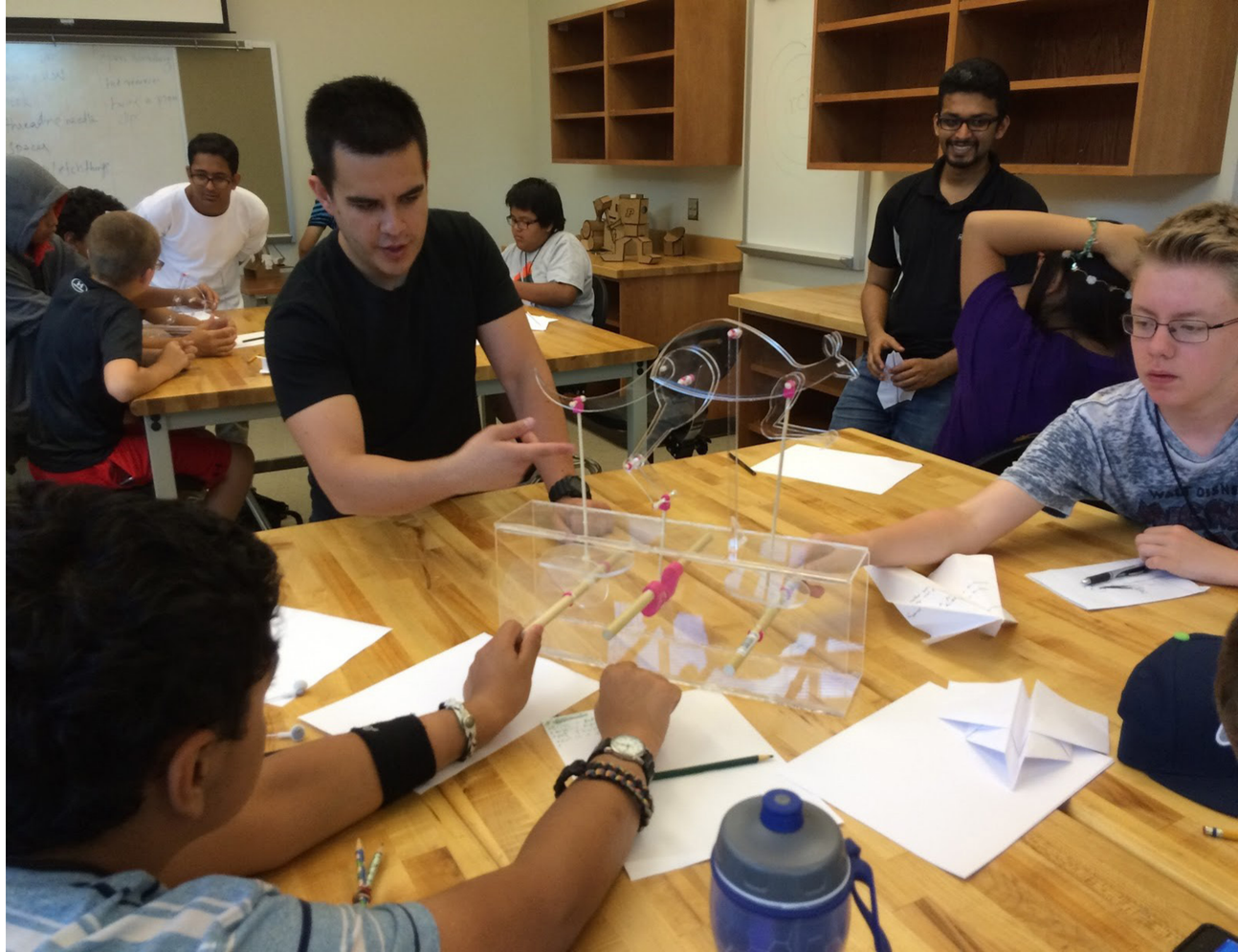
FUNCTIONAL PROTOTYPES







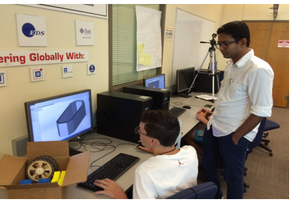
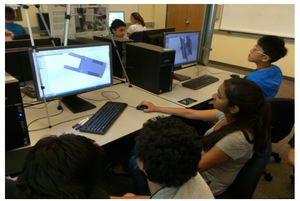
ACTIVITY: *STORY TELLING AND ROBOTS*

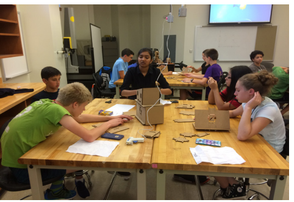
Students were tasked with an open ended design problem to make robots in teams that can be used to tell a story. The designing and prototyping of the story was based on principles learnt in the workshop.

Materials:
- Cardboard
- Ziro Modulus
- Glue Gun
- Scissors
- Paper
- Pencil
- SolidWorks
- Laser cutter
- 3D Printer

Key Concepts:
- Prototyping
- Apply principles to physical products
- Collaboration, team based design

SKETCHING/ PROTOTYPING

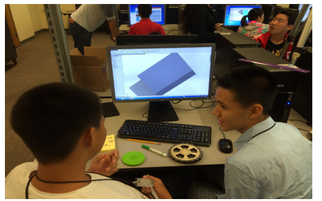
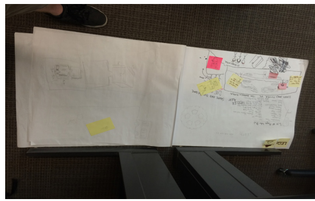
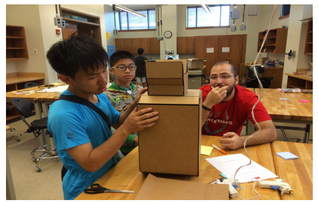



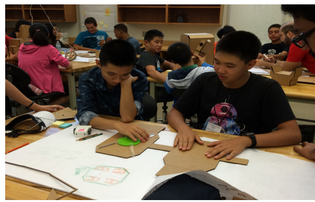


"Mechanisms are useful for machines." - James

"We 3D modelled the robot and its appendages, created the general idea of the skit, we built the entire robot" - Cole



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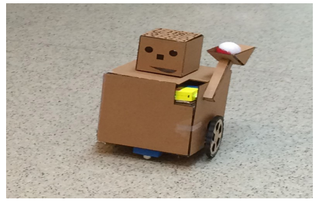

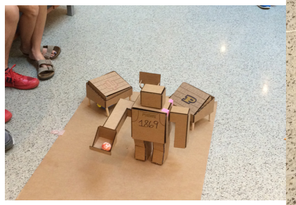

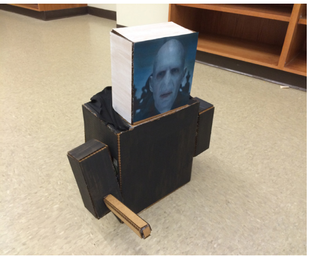

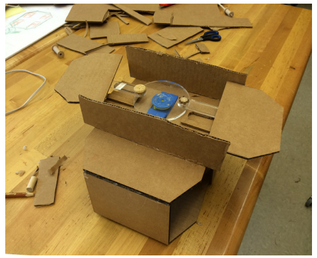

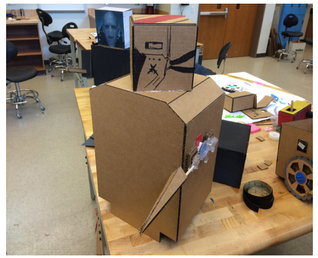

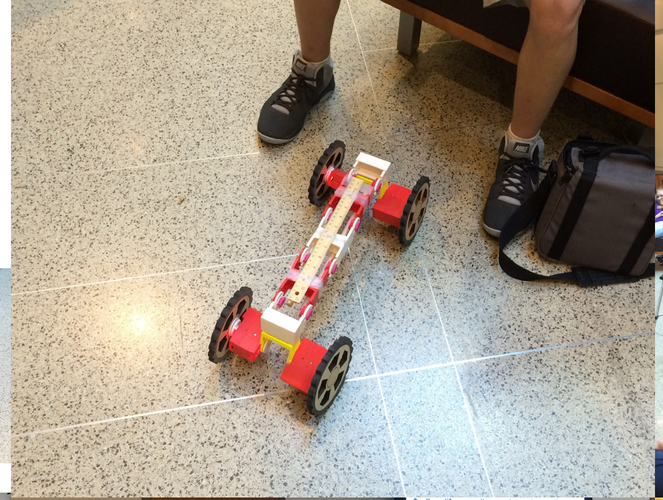

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