

Atholton High School Columbia, MD.

Project Lead the Way
The Student Perspective

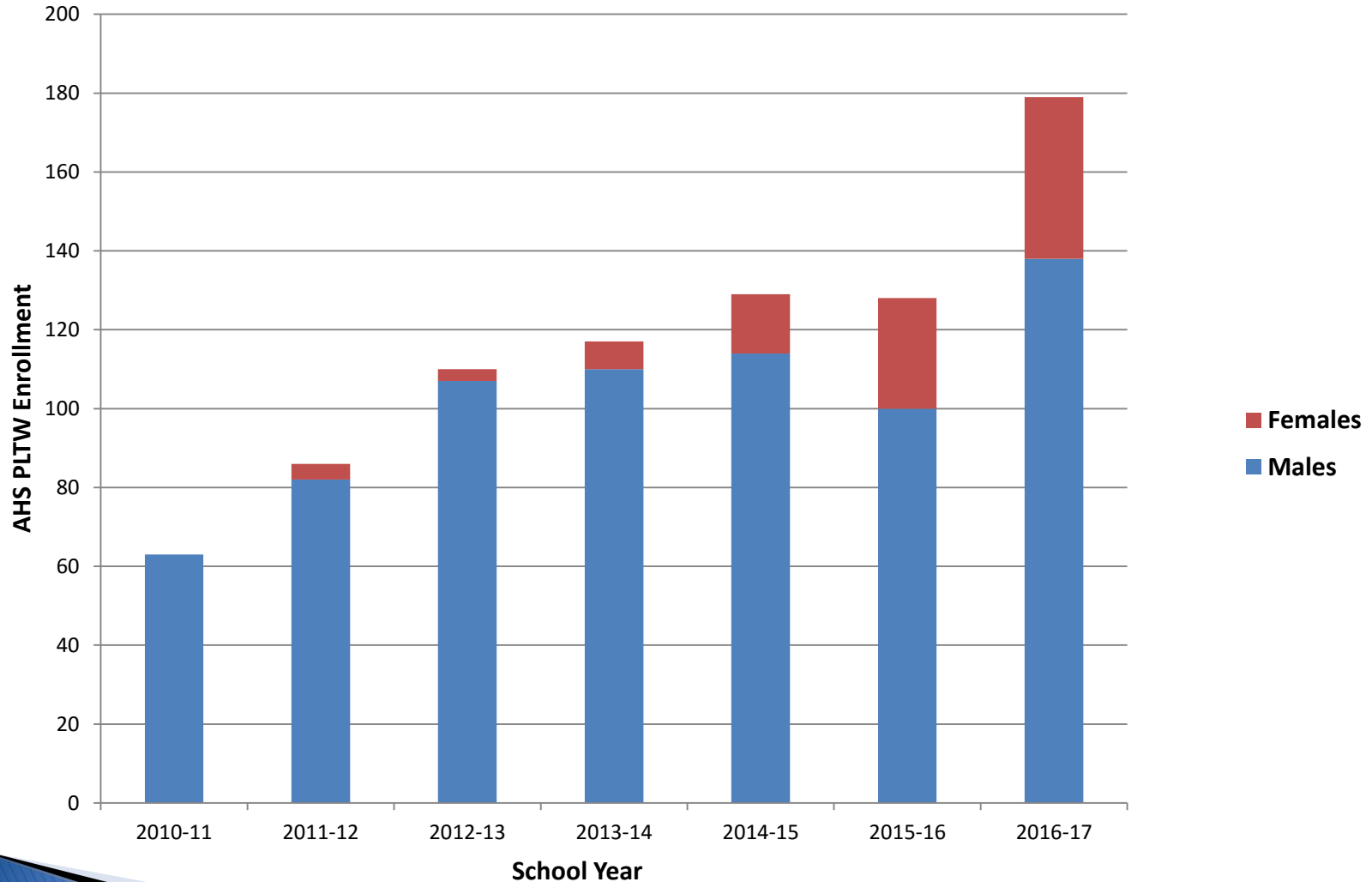
"TELL ME AND I FORGET,
TEACH ME AND I MAY REMEMBER,
INVOLVE ME AND I LEARN."

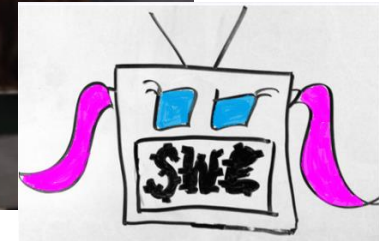
~ BENJAMIN FRANKLIN

A Four Year Plan

9th Grade	10th Grade	11th Grade	12th Grade
English 9	English 10	English 11	English 12
Algebra I or above	Geometry or above	Algebra II or above	Math Elective
Science	Science	Science	Science
U.S. History	American Government	World History	Elective
World Language	World Language	Elective	Elective
Lifetime Fitness/Health	Fine Arts	Digital Electronics G/T	Elective
PLTW (Introduction) to Engineering Design G/T Tech Ed Credit	Principles of Engineering G/T	Computer Integrated Manufacturing G/T	Engineering Design and Development G/T

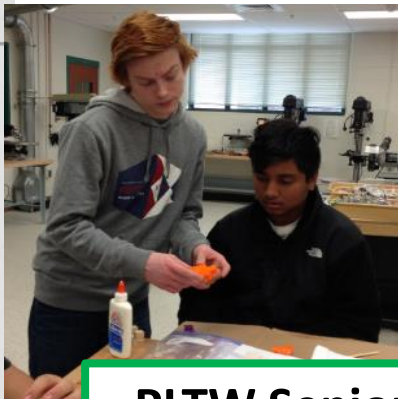
Growth of the AHS PLTW Program





Providing Service A School Community

- Middle School FLL Leagues
- Mentor PLTW IED Students



**PLTW Seniors
are Engineering
Department
Aides !!**



SOPHOMORES



Molly

Jake



Heather



SENIORS



Jaylan

Jetta



Brian



Molly



PLTW Sophomore

Currently enrolled in Principles of Engineering (POE)
Took Intro to Engineering Design (IED) as a Freshman

Other Interests:

Theater

Other Interests:

Theater

Soccer

Next Steps Continuing with PLTW or
transferring to a Centralized Academy for Engineering

Why Did I Join PLTW ?

“I didn’t really know any engineers but I always liked building things. When I heard about PLTW in 8th grade, I signed up.” Jake

*“I didn’t know that PLTW was a thing. I found out that PLTW was a whole program after I got started. Now I plan to stay in it.”
Heather*

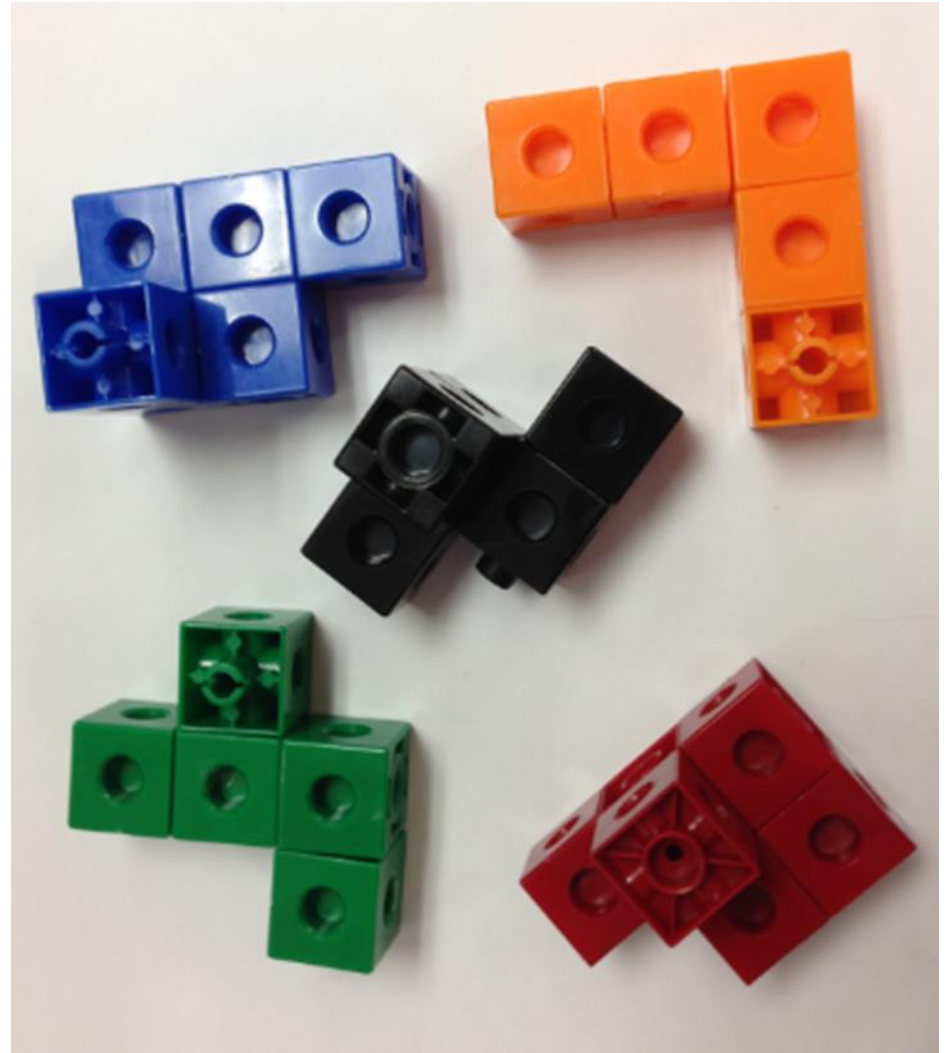
*“A PLTW teacher came to talk to us in 8th grade. I was interested and wanted to learn more. Now I plan to major in engineering.”
– Kareem, PLTW Junior*

“You get your Tech Ed credit out of the way so you really can’t lose”

PLTW Intro to Engineering is the only GT (weighted) Technology Education credit available at Atholton.

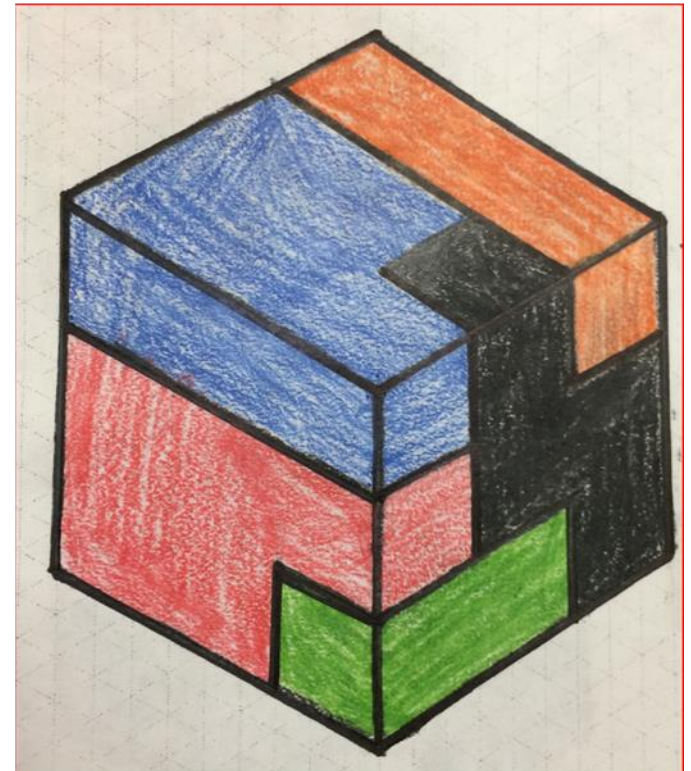
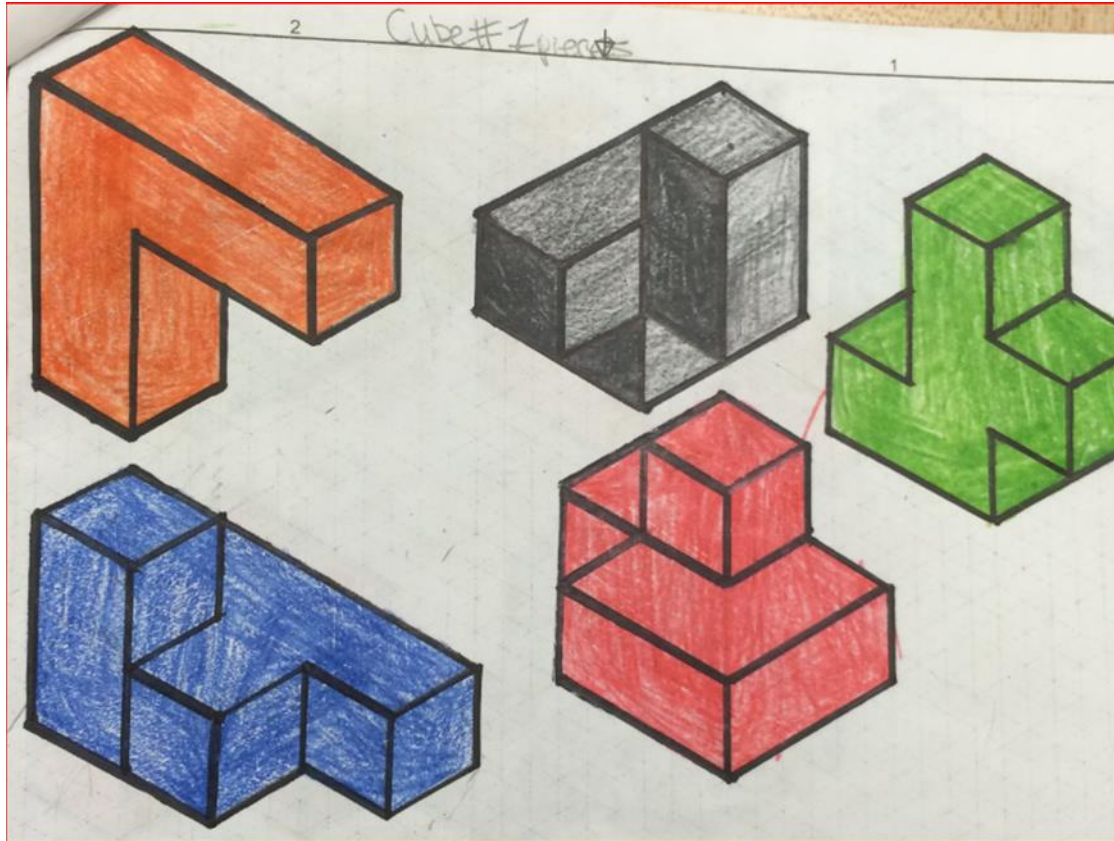
Introduction to Engineering Design

Puzzle Cube Challenge

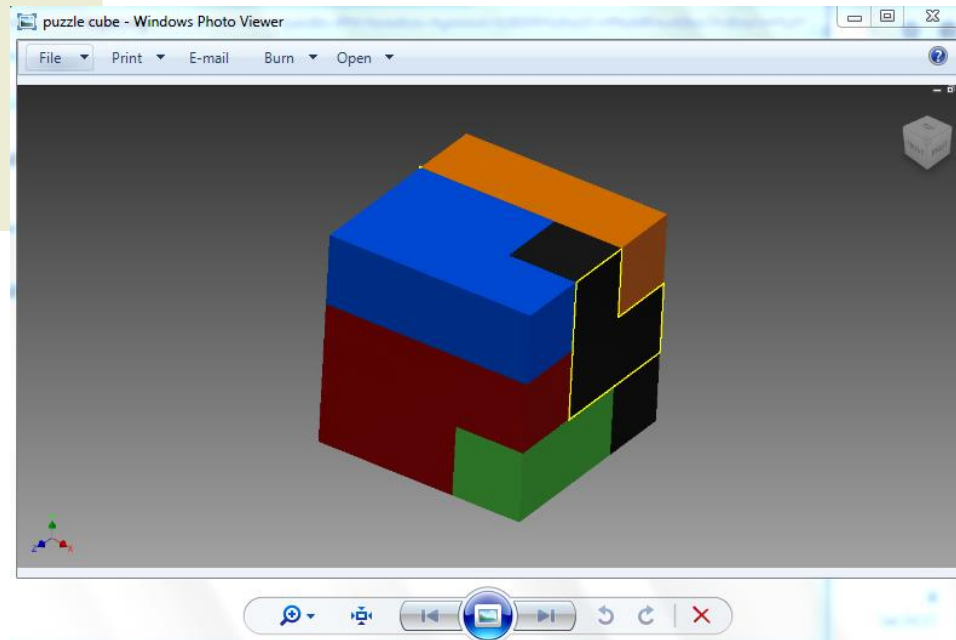
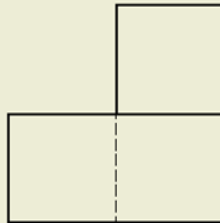
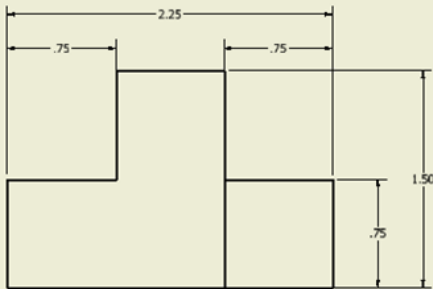
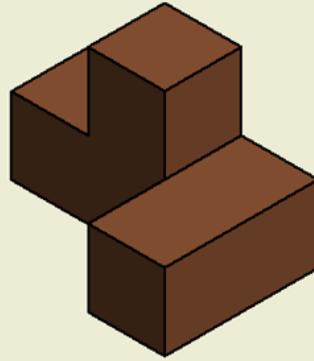
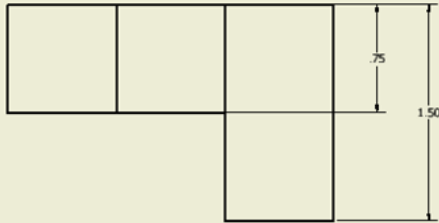


Introduction to Engineering Design

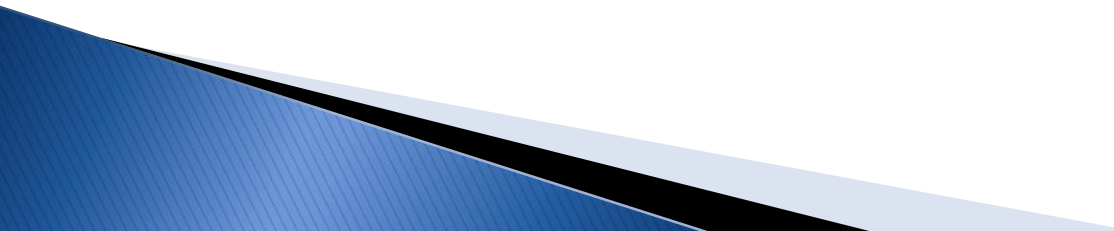
Puzzle Cube Challenge



Puzzle Cube Challenge



Puzzle Cube Challenge Skills

- ▶ The Engineering Design Process –
*Defining the Problem, Brainstorming
Solutions, Designing, Prototyping,
Evaluating, Presenting Design*
 - ▶ Isometric (3D) and Multiview Drawings
 - ▶ Line Conventions
 - ▶ Dimensioning
 - ▶ CAD Modeling
- 

Jake



PLTW Sophomore

Currently enrolled in Principles of Engineering (POE)
Took Intro to Engineering Design (IED) as a Freshman

Other Interests:

Soccer

Cooking

Skateboarding

Next Steps

Continuing with PLTW,
possible career as an Astronomer

How is PLTW Different than My Other Courses?

The classes are largely student run. We work in teams to solve problems. Other classes seem easier and less fun because you are told step-by-step how to do everything. This is much more creative. Jake

There is lots of room for creativity; there is no one right answer. Heather

We are doing something!
– Ross, PLTW Junior

We are solving real world problems and learning skills that we will use no matter what we do.

Introduction to Engineering Design

Virtual Design Challenge:

Locker Organizer

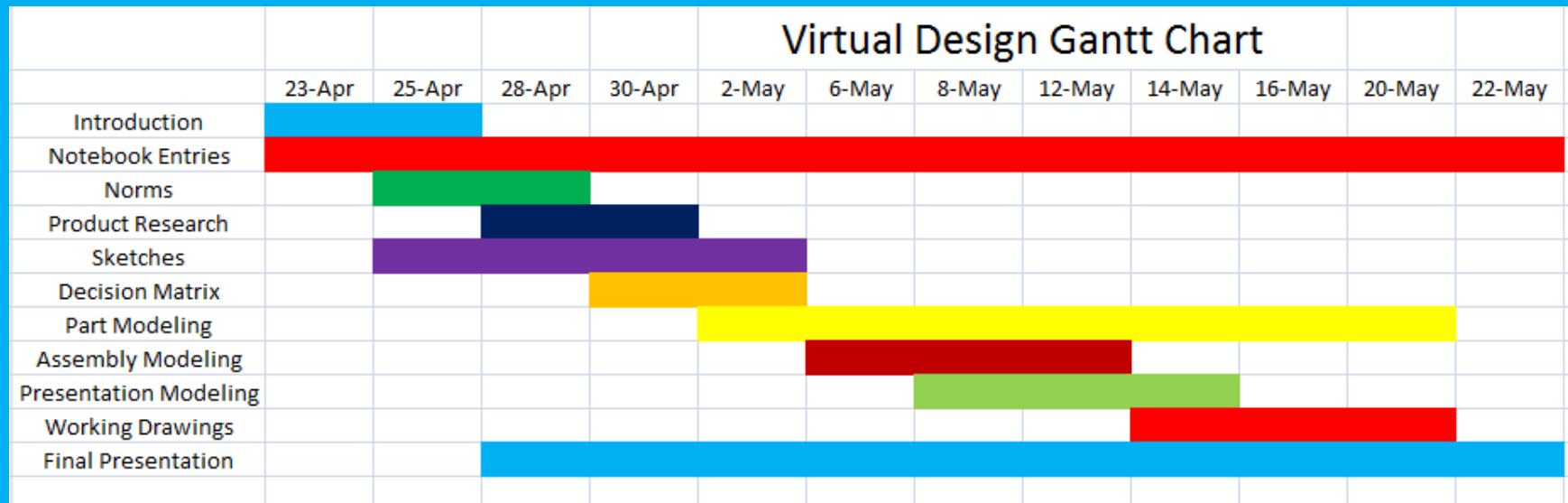
Jake Morales

Brandon Rohrbach

Olivia Maggio



Gantt Chart



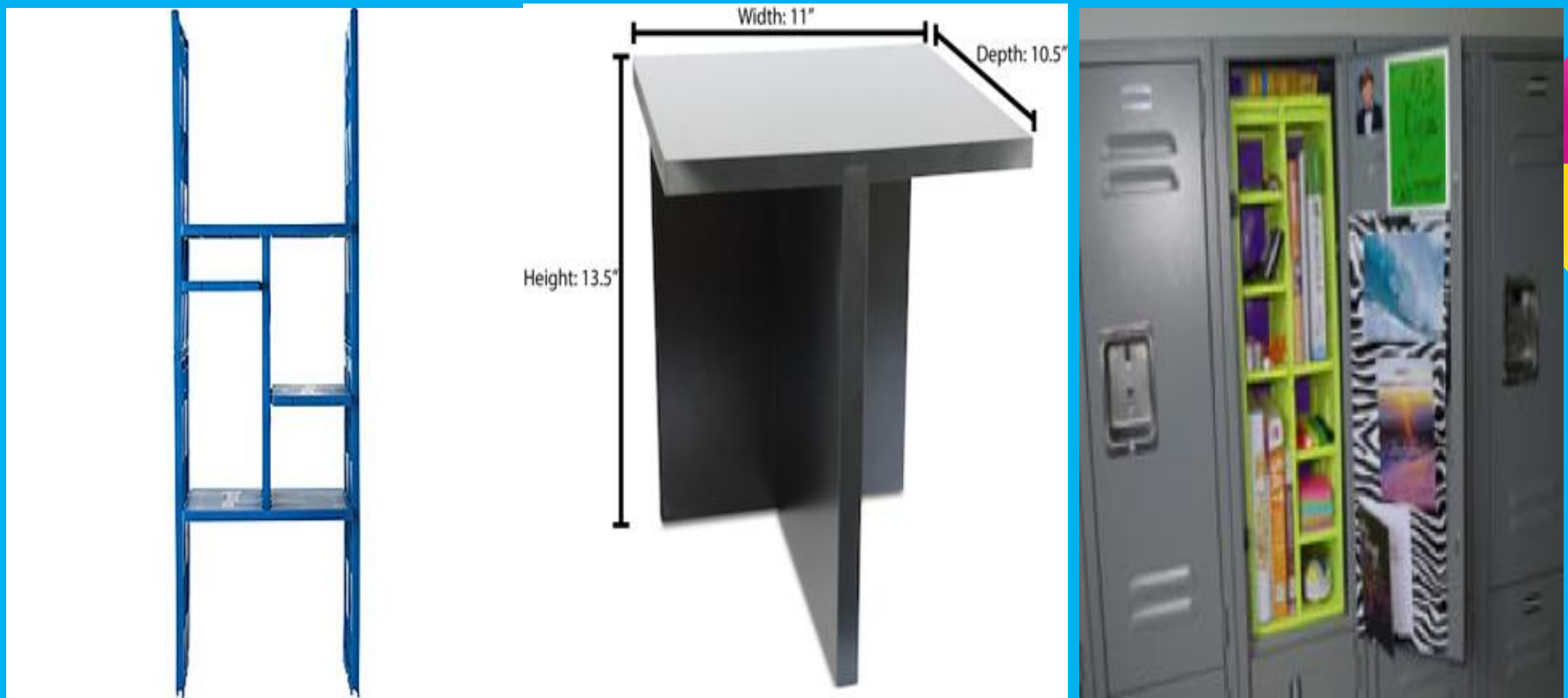
Olivia's Product Research

Third Design: Portable backpack locker organizer

I love this design because it's not only a locker organizer, but it also organizes your backpack, so your school work is easy to find. It's also great for sports, it's not too much to handle.

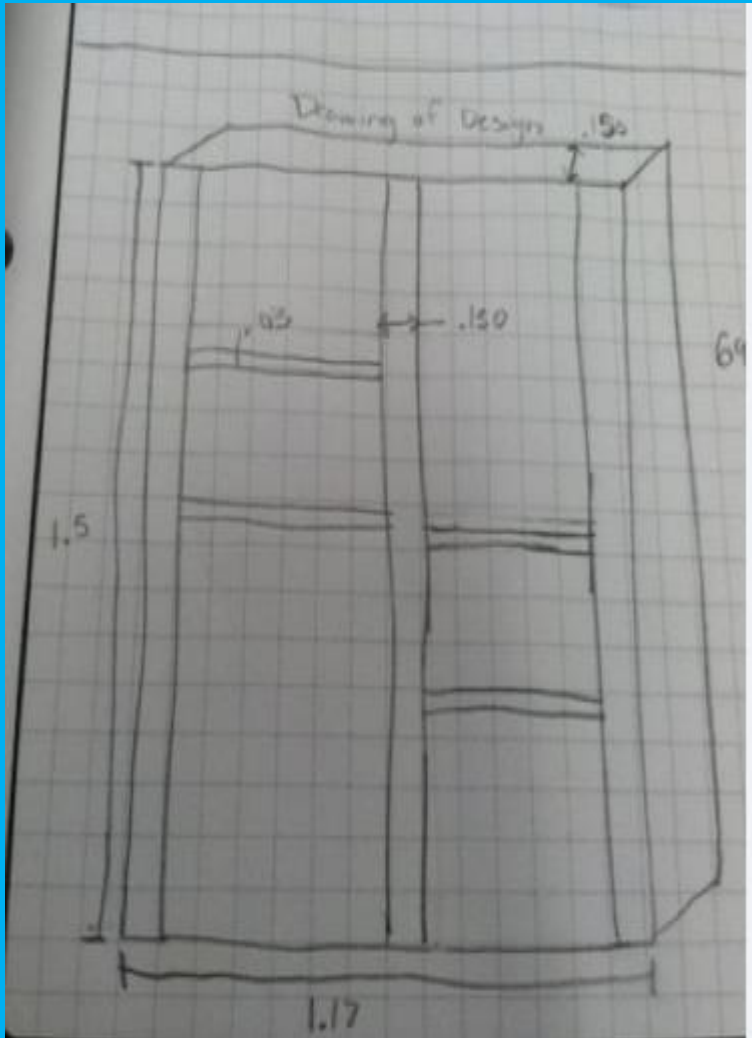


Brandon's Product Research



The first and third idea are pretty similar, with many shelves. The second idea is a little different, where there are three main sections (two on the sides and one on top).

Brandon's Sketch



This locker organizer has six shelves, three on each side. One on each side is big enough to fit books and binders. The other four shelves are more medium sized, each being able to hold smaller objects. Shoes, a lunch box, or any other item is meant for these shelves. The top of the organizer can have objects that are not that long on it, even if they are index cards or Post-It-Notes.

Decision Matrix

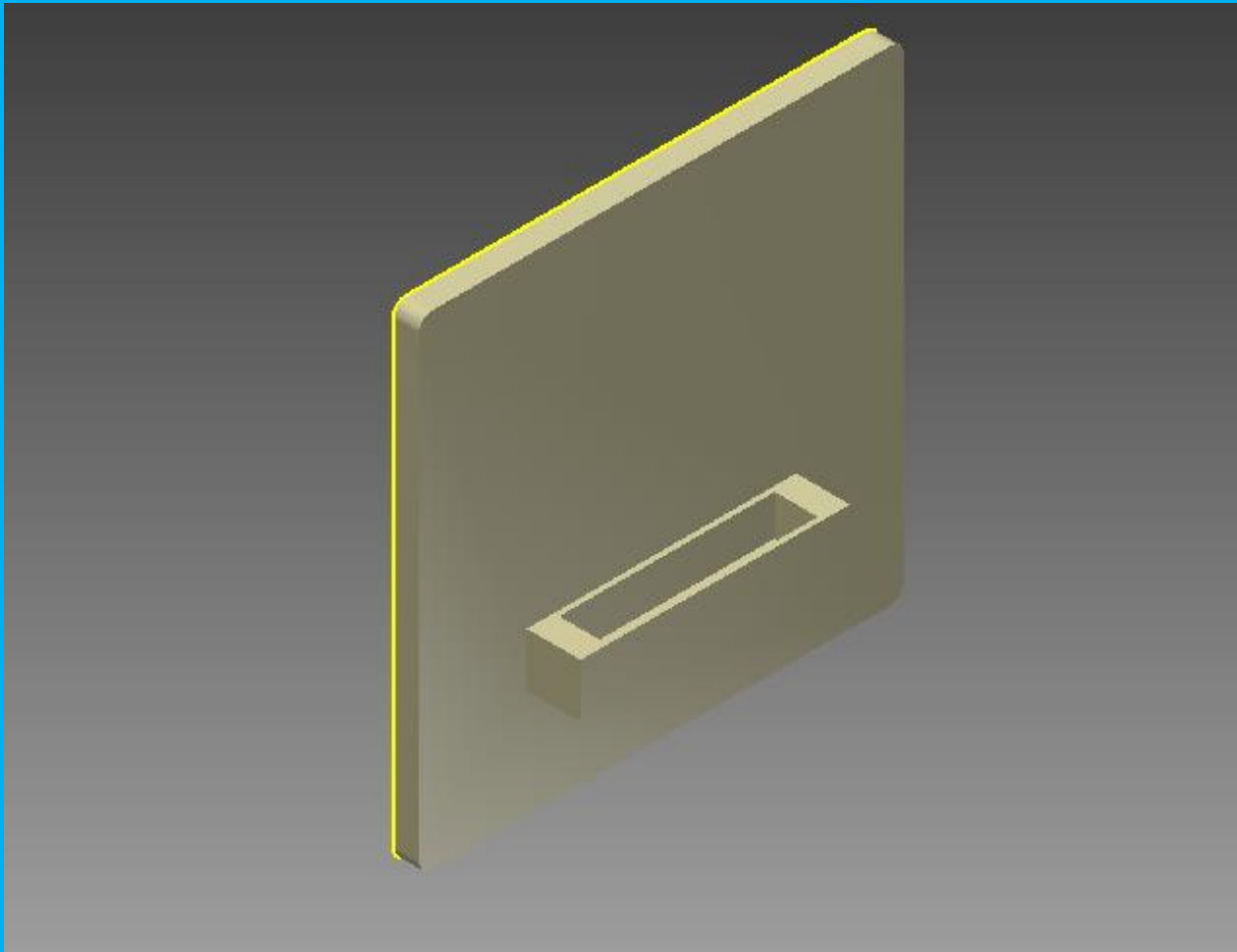
Project 9.3m Decision Matrix Template

Criteria							
Ideas	Aesthetically Pleasing	easy to install	Popular among high	Easily hold many items	no flammable materials	finish in next 2 weeks	Totals
Jake Mini pockets	3	3	2	2	4	3	17
Jake Sleeve Pockets	3	3	3	3	3	2	17
Olivia First Sketch	4	4	4	3	3	3	21
Olivia Second Sketch	4	3	3	3	3	3	19
Brandon	4	3	3	4	4	3	21
Brandon	na	na	na	na	na	na	0

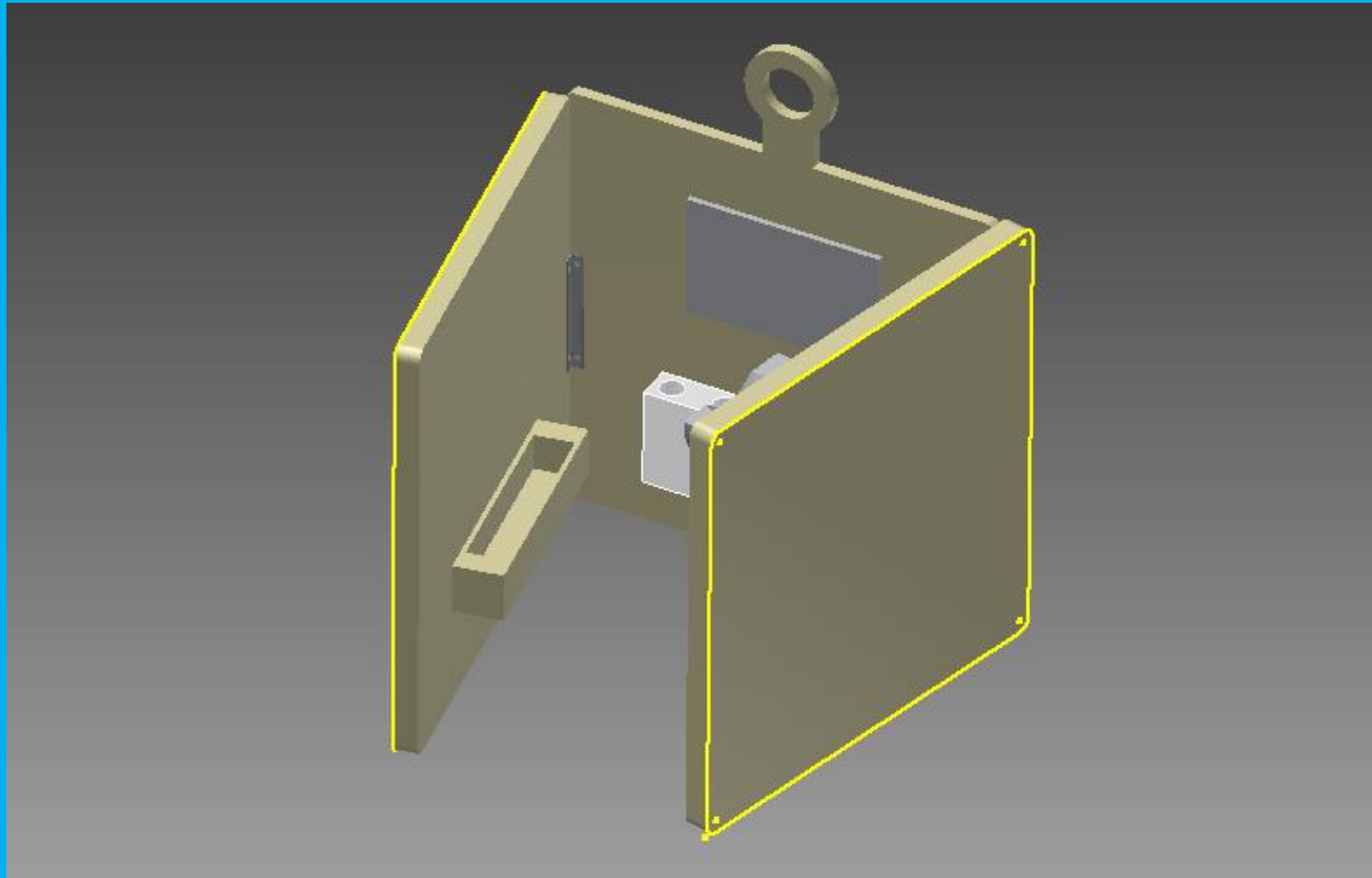
Do not type in column H. As scores are entered, totals will calculate automatically.

Scale: 4 3 2 1
strongly agree agree disagree strongly disagree

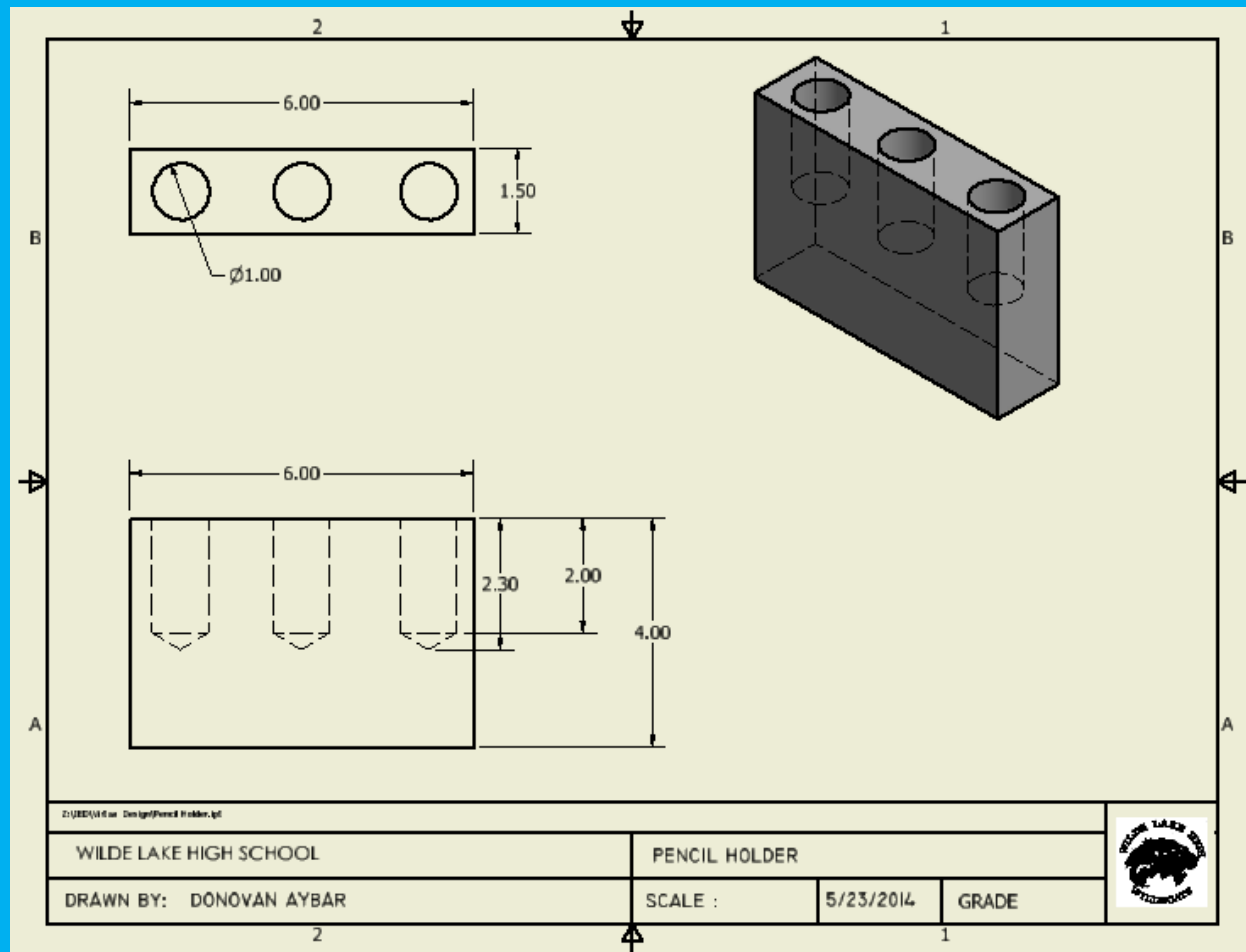
Part .ipt: Side Piece



Assembly



Multiview Sketches: Pencil Holder



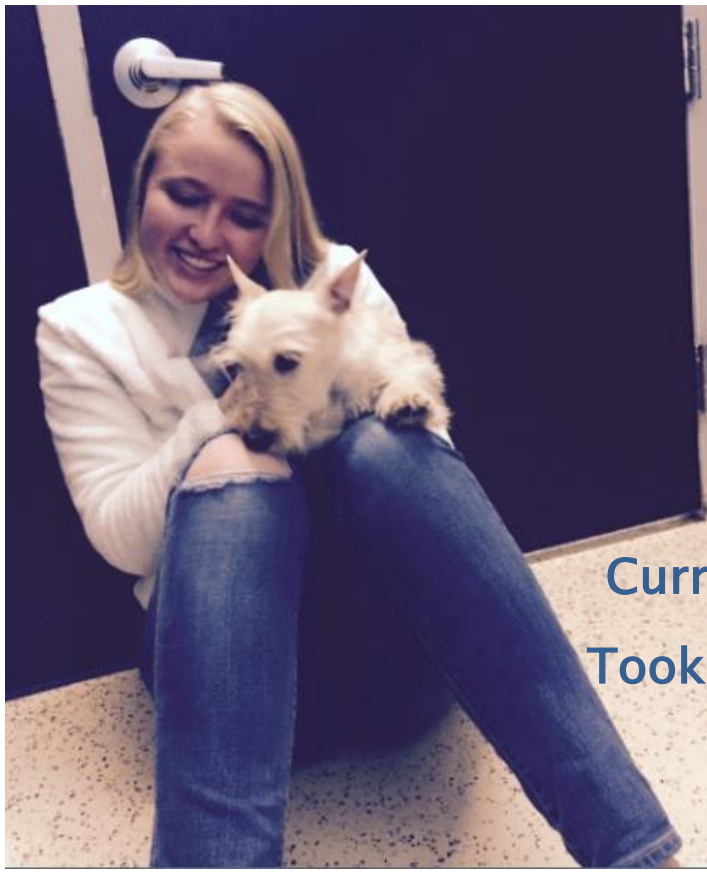
Virtual Design Challenge Skills

▶ New Skills

- Professional Communication
- Scheduling (Gantt Chart) and Division of Work
- Decision Matrix
- Oral Presentation

▶ Reinforced Skills

- The Engineering Design Process – *Defining the Problem, Brainstorming Solutions, Designing, Prototyping, Evaluating, Presenting Design*
- Isometric and Fully Dimensioned Multiview Drawings
- CAD Modeling



Heather

PLTW Sophomore

Currently enrolled in Principles of Engineering (POE)
Took Intro to Engineering Design (IED) as a Freshman

Other Interests:

Soccer

Engineering

Next Steps Continuing with PLTW
or transferring to a
Centralized Systems Engineering Academy

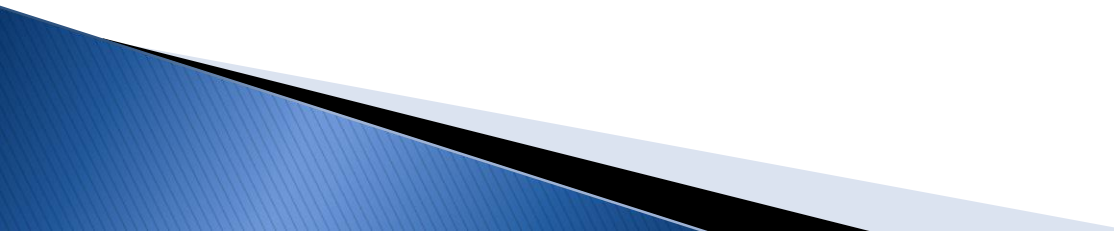
PLTW Experience Makes Science and Math “Real”

We are having as easier time in Chemistry than other students because we already understand how to do unit conversions and significant figures from IED last year. – Molly, Jake and Heather (G/T Chem)

Because of our experience with projects in PLTW, chemistry labs seem easier but less fun than engineering labs because they explain every step . Science labs are more straight forward but not as creative.

– Molly , Jake and Heather (G/T Chem)

I've decided to major in architecture but I'm staying in PLTW. It has taught me so much about teamwork and problem solving. – Teddy, PLTW Junior



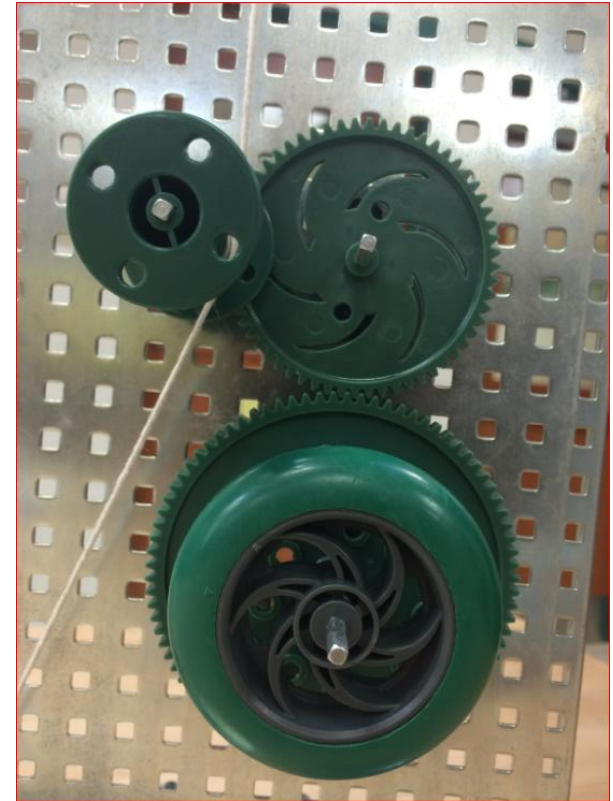
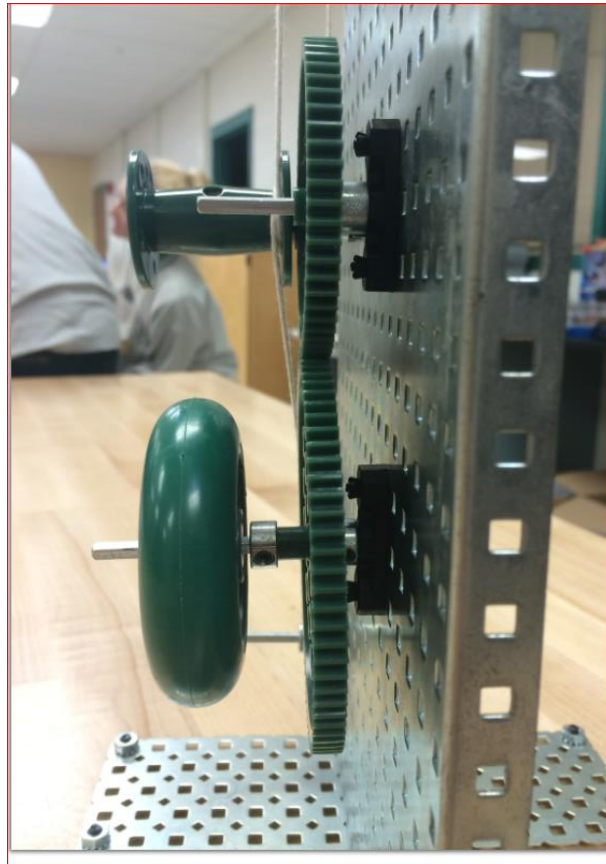
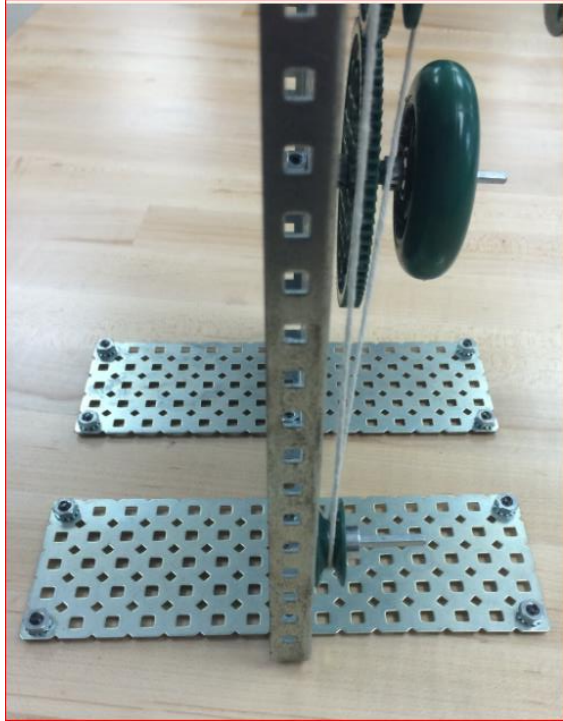
Using PLTW Skills in Pre-Calculus

I was able to apply what we were doing in POE to what we were learning in pre-calc about linear relationships. I could picture what was going on because we had built something like this in POE.

Pre Calc Problem – September 2015

Pulleys: Two pulleys, one with a radius of two inches and the other with a radius of 14 inches, are connected by a belt. If the two inch pulley is caused to move at a rate of three revolutions per minute, determine the revolutions per minute of the 14 inch pulley.

Computing and Measuring Mechanical Advantage in POE



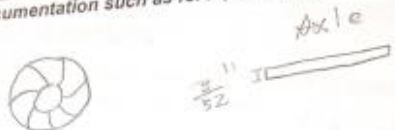
POE Project – Compound Machine Design

Pre-Calc in Action

drive ratios of the machine solution. Show work and units.

Mechanism 1 Type wheel and axle

Illustration: Include proper documentation such as force, distance, direction, and key mechanism features.



Mechanical Advantage / Ratio Calculations

Formula	Substitute / Solve	Final Answer
$IMA = \frac{DE}{DA}$	$\frac{11}{\frac{3}{32}} = \frac{29.3}{2} = 14.6$	$IMA = 14.6$

Mechanism 2 Type gear train

Illustration: Include proper documentation such as force, distance, direction, and key mechanism features.



Mechanical Advantage / Ratio Calculations

Formula	Substitute / Solve	Final Answer
$GR = \frac{T_{out}}{T_{in}}$	$GR = \frac{12}{84} = \frac{1}{7}$	$1:7$

Mechanism 3 Type Pulley system

Illustration: Include proper documentation such as force, distance, direction, and key mechanism features.



Mechanical Advantage / Ratio Calculations

Formula	Substitute / Solve	Final Answer
$IMA = \text{strands}$	$IMA = 2$	$IMA = 2$

8. Calculate total/overall system mechanical advantage.

Formula	Substitute / Solve	Final Answer
$(IMA)(GR)(IMA)$	$(14.6)(\frac{1}{7})(2) = 4.19$	$2.10:1$

Conclusion Questions

- For which mechanism was it the easiest to determine the mechanical advantage or drive ratio? Why was it the easiest? Pulley system because there was only one strand.
- For which mechanism was it the most difficult to determine the mechanical advantage or drive ratio? Why was it the most difficult? wheel and axle was the hardest because there were complicated numbers.
- At what value would you estimate the input and output forces of your compound machine? How did you arrive at your estimated values? Input is ~2 lbs, Output is ~4.2 lbs. We multiplied the estimated input and the overall mechanical advantage.
- What modifications could you make to your compound machine to make it more mechanically efficient? We would add washers and lubrication to reduce the rotation friction.

“Involve Me and I Learn”

“As much as we would like to, we cannot transfer experience.”
– Dr. Surya Raghu, PLTW mentor

PLTW has made me more organized and responsible. It is student driven and somewhat self-paced so I learned to manage myself. – Derek, PLTW Junior

I use the *Engineering Design Process* to get through projects in my other classes. – Ryan, PLTW Junior

Many of the things that we are learning in calculus, chemistry and physics we have already seen in engineering. Because we are actually using the information in engineering, it helps us to pick out what is important.
– Jacob, PLTW Junior

I am better at taking notes now because I don't just write down everything. I listen more and pick out what is important. I also know that I can go back to the *Powerpoint*s and look up anything that I missed. – Ross, PLTW Junior



Jaylan

PLTW Senior

Currently enrolled in Engineering Design and Development (EDD)

Capstone Project:

Other Interests:

Robotics – Outreach Lead

FBLA

Cycling

Music

Engineering Department Aid

Plans: Study Engineering in College

An Atmosphere of Positive Competition

We learn more from each other than in any other class. We are always exploring different ways to solve a problem. Brian

We help, but at the same time challenge, each other. Jaylan

Everything is student run. There is a desire to do well. We are pretty competitive. – Jetta

We are given the freedom to explore. There is much less copying because there is rarely one right answer. Heather



Digital Electronics – Date of Birth

2.4.1 Combinational Logic: Jaylan Hall
Date of Birth

Display	X	Y	Z	A	B	C	D	E	F	G
1	0	0	0	0	1	1	0	0	0	0
1	0	0	1	0	1	1	0	0	0	0
-	0	1	0	0	0	0	0	0	0	1
2	0	1	1	1	1	0	1	1	0	1
0	1	0	0	1	1	1	1	1	1	0
-	1	0	1	0	0	0	0	0	0	1
9	1	1	0	1	1	1	1	0	1	1
8	1	1	1	1	1	1	1	1	1	1

①

X	Y	Z	A
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	1

$A = \overline{X}Y + XZ$

②

X	Y	Z	B
0	0	0	1
0	0	1	1
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	1

$B = \overline{X}\overline{Y} + \overline{X}Z + XY + XZ$

③

X	Y	Z	C
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	1

$C = \overline{X}\overline{Y} + X\overline{Y} + XZ$

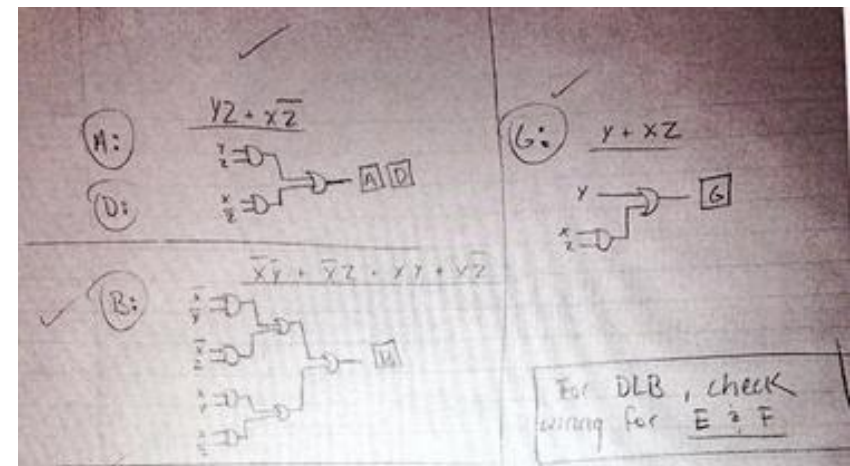
Problem Statement



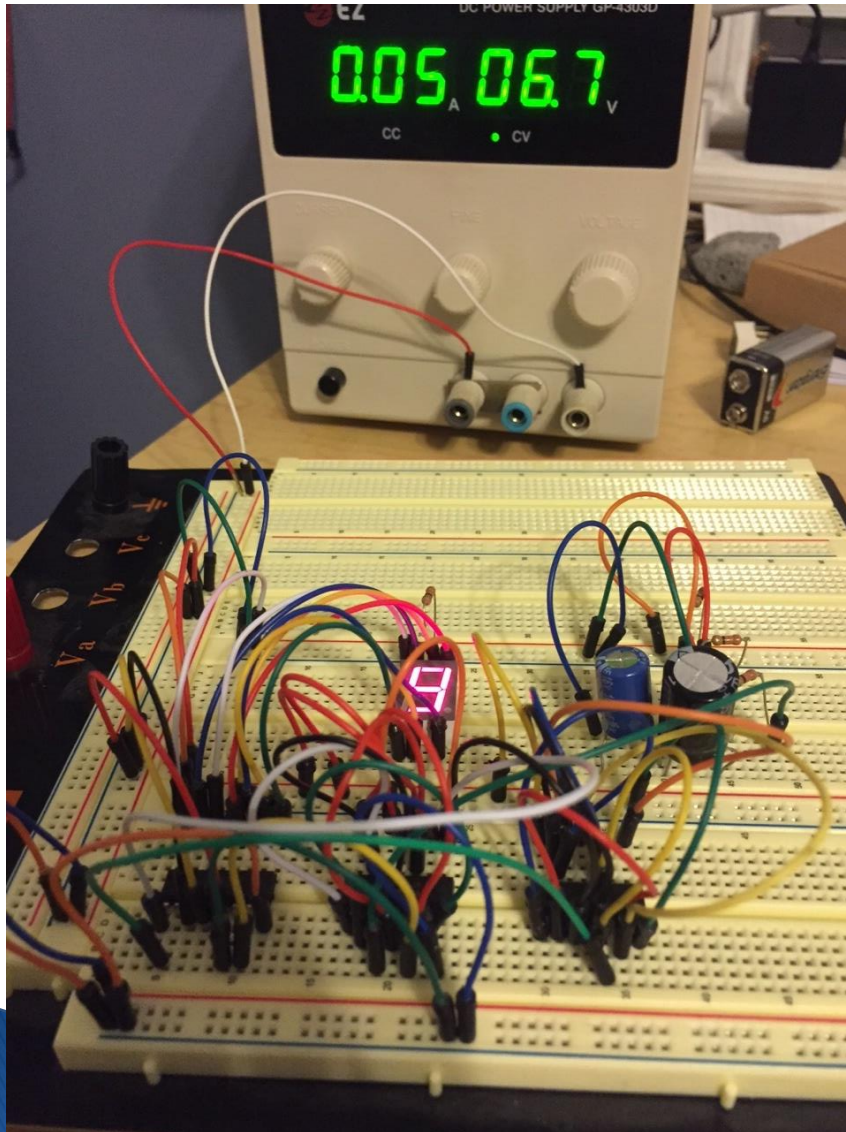
Truth Table



Logic Equations

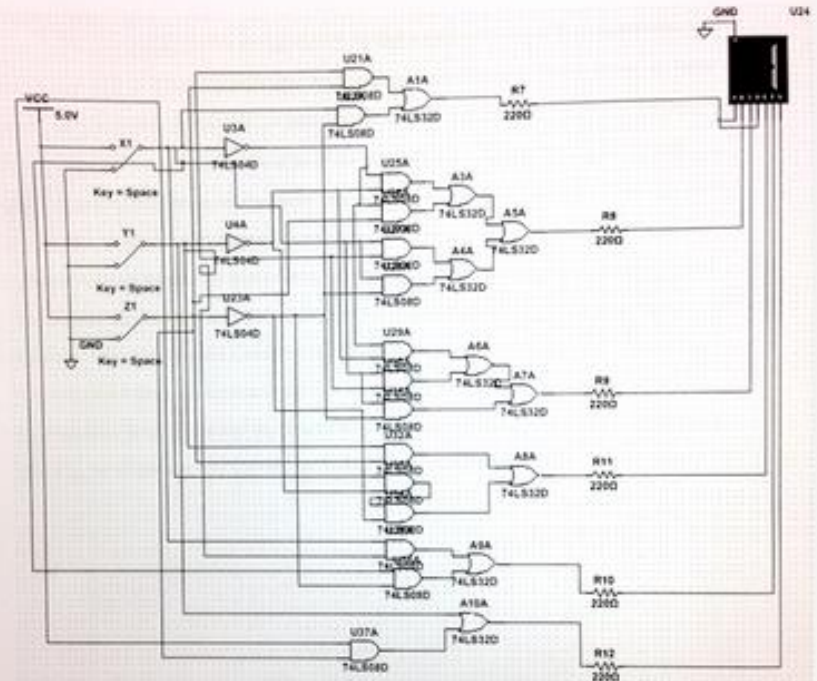


Digital Electronics – Date of Birth



Simulate → Evaluate

Prototype → Evaluate





Jetta

PLTW Senior

Currently enrolled in Engineering Design and Development (EDD)

Capstone Project: Detailing RVs

Other Interests:

Soccer / Basketball

Student Government Association

Engineering Department Aid

Student Women Engineer Founding Member

FLL and PLTW Mentor

Plans: Attend the US Air Force Academy to study Mechanical Engineering and be a pilot one day.

When Did I Know that Engineering Would be my Path?

“Engineering is the place to be – jobs, creativity, always changing.” Heather

“I joined PLTW because my brother told me the classes were fun; now I want to be an engineer.” Jetta

My brother took his 1st engineering course as a high school senior. Now he studies engineering in college and loves it. He told me to get an earlier start.

When I started PLTW (Mom’s idea) I wasn’t too into it, but my interest grew. Now I am applying to engineering school. Brian



Maker Space – Turning Ideas to Product



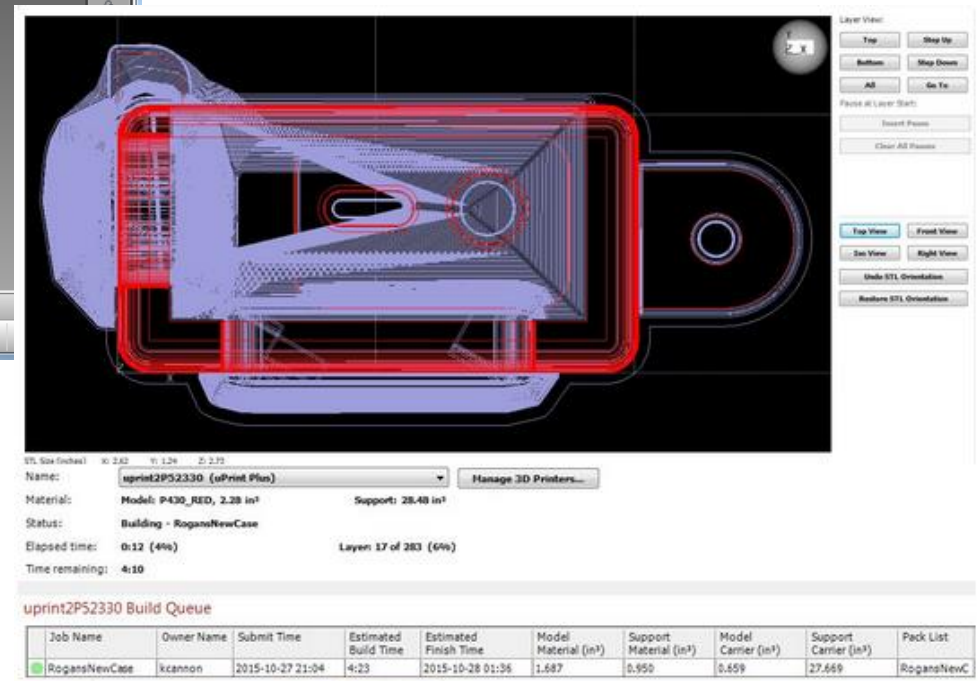
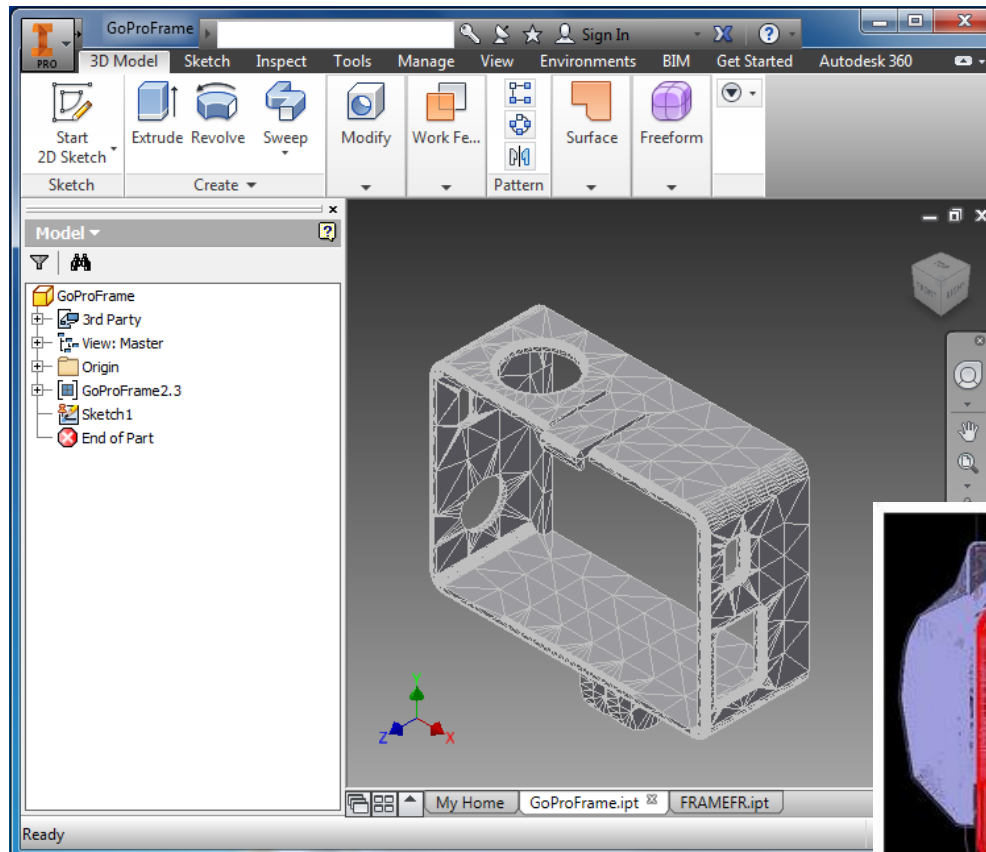
*Courtesy of Rogan,
PLTW Senior*



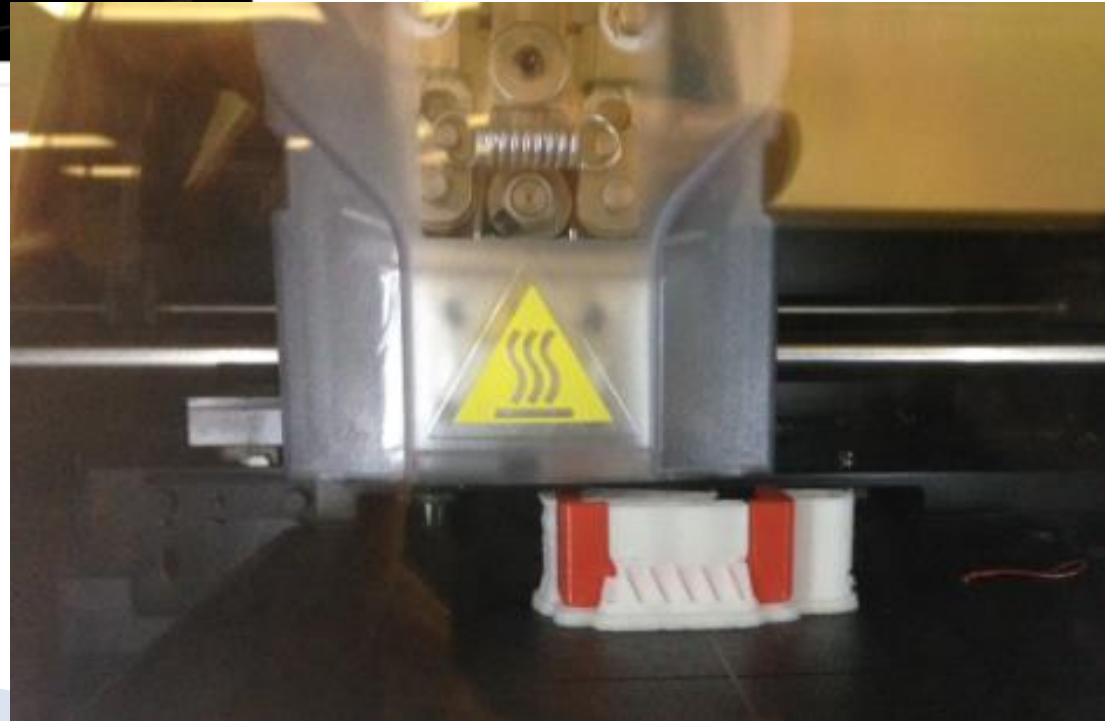
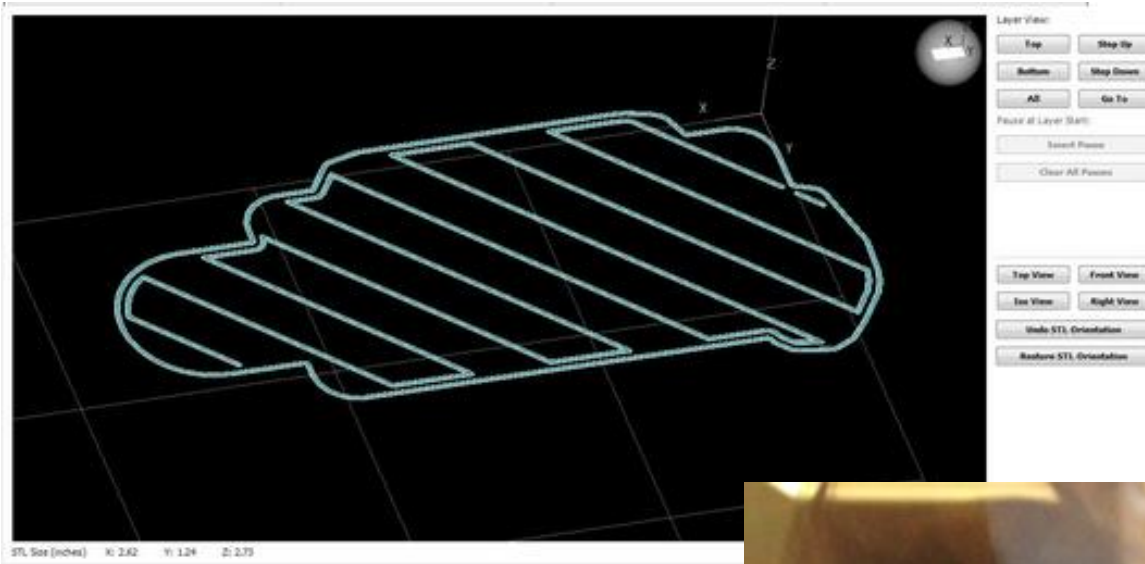
*In engineering you must “Fail
Often to Succeed Sooner.”
CEO of IDEO*



My Idea -> CAD -> 3D Printer



My Idea -> CAD -> 3D Printer





Brian

PLTW Senior

Currently enrolled in Engineering Design and Development (EDD)

Capstone Project: Modular Power

Other Interests:

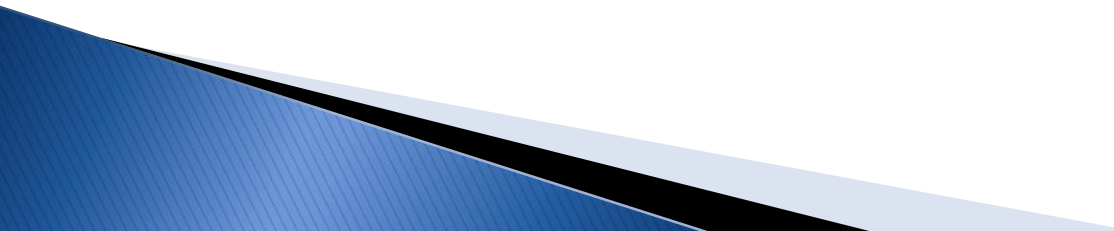
Skateboarding / Snowboarding / Baseball

Engineering Department Aid

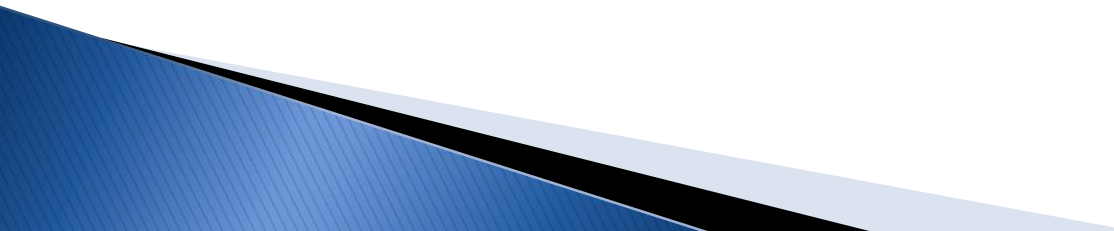
FLL and PLTW Mentor

**Plans: To major in Mechanical Engineering at
University of Maryland**

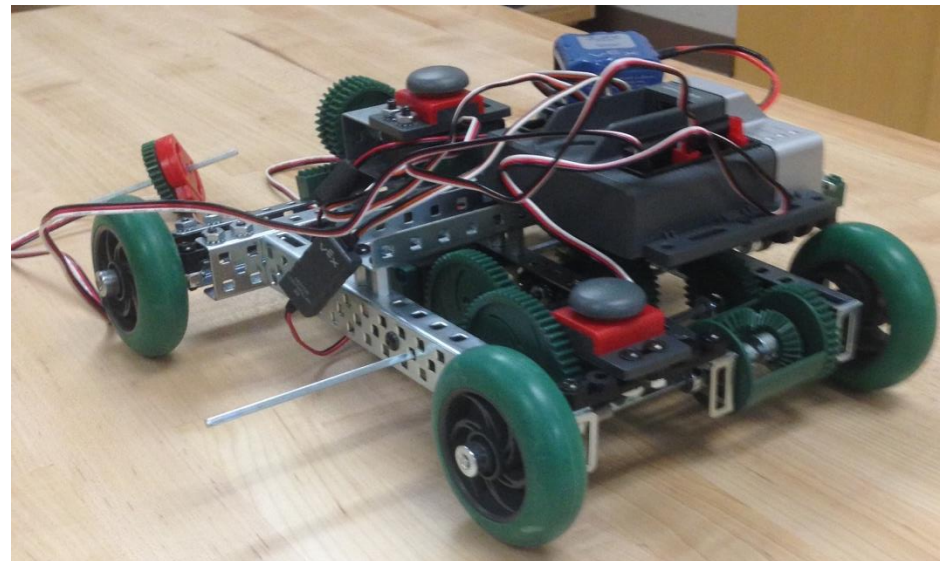
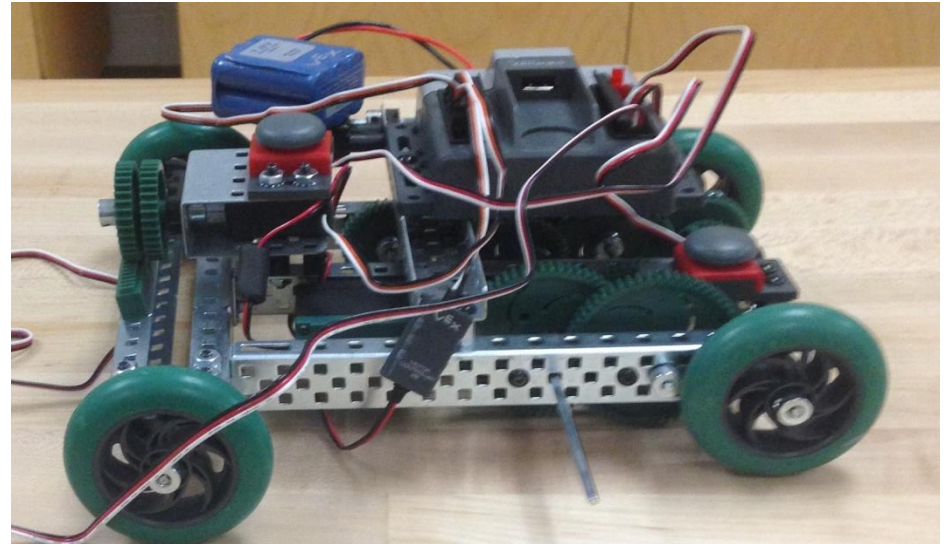
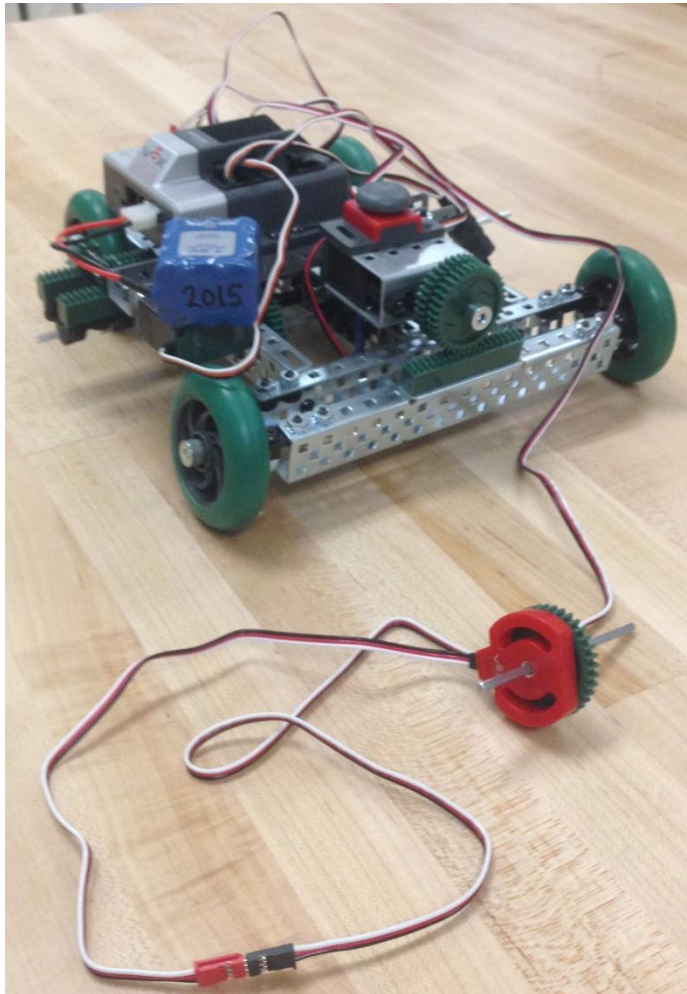
Curriculum Keeps Students Interested

- ▶ PLTW assignments often allow students to select a topic that is of particular interest to them
 - ▶ Teaching and learning is done in a hands-on and interactive way.
 - ▶ Curriculum is set at the right pace – enough time to understand material, but fast enough to cover a lot of valuable information.
 - ▶ Students develop genuine interest in engineering and are eager to learn – they are not just there for the grade
- 

Prepares Students for College & Careers

- ▶ Students learn to cooperate with one another and use teamwork to their advantage
 - ▶ Assignments encourage students to think creatively and innovatively
 - ▶ Students solve real world problems like they might in a work environment
 - ▶ Students develop good study habits and work ethic through the learning of new and challenging information
- 

Autonomous Car



Autonomous Car RobotC Code

The system stops when the final constructed piece hits the limit switch.

```
*/
task main()
{
    while(1==1)                                //keeps this program running continuous
    {
        if(SensorValue(bumpSwitchKill)==0)
        {
            untilBump(bumpSwitchStart, 1);        //click bumpSwitch to start program
            startMotor(rightMotor, -45);          //right motor spins backward at a speed of 45
            untilSonarLessThan(3035, lineFollowerRight); //when the object is infront of the line follower the motor will stop
            stopMotor(rightMotor);                //motor stops
            wait(1);
            untilSonarGreaterThan(3035, lineFollowerRight);
            untilSonarLessThan(3035, lineFollowerRight); //Motor will start again when the part leaves and returns to the track
            startMotor(rightMotor, -45);          //right motors motor spins backward at a speed of 45
            untilSonarLessThan(3035, lineFollowerLeft); //stops motor when part reaches this sensor
            stopMotor(rightMotor);                //motor stops
            wait(1);
            untilSonarGreaterThan(3035, lineFollowerLeft);
            untilSonarLessThan(3035, lineFollowerLeft); //Motor will start again when the part leaves and returns to the track
            startMotor(rightMotor, -60);          //right motor spins backward at a speed of 60
            untilBump(limitSwitch, 1);            //motor stops when the piece falls and hits the limit switch
            stopMotor(rightMotor);                //motor stops
        }
    }

    else
    {stopMotor(port2);}
```

My PLTW Experience Will Help Me to Succeed in College

I know that I am interested in engineering and that engineering is a very difficult major. I think that PLTW is giving me the “leg up” that I will need. Jake, PLTW Junior

Unlike college engineering programs, PLTW is very encouraging. I am entering college knowing that I have this background. Heather

“If I want to impress someone, I play the PLTW card.” Heather

Some students will have more AP credits than I do going into college but I will have so much hands-on experience from PLTW. I think that will give me an advantage. Brian

I applied for RIT credits for my PLTW courses. Even if I don't go to RIT it looks good to have college courses on my resume. Jaylan