

LEMELSON-MIT

Celebrating invention, inspiring youth

Working with Materials: PVC Pipe and Framing Systems

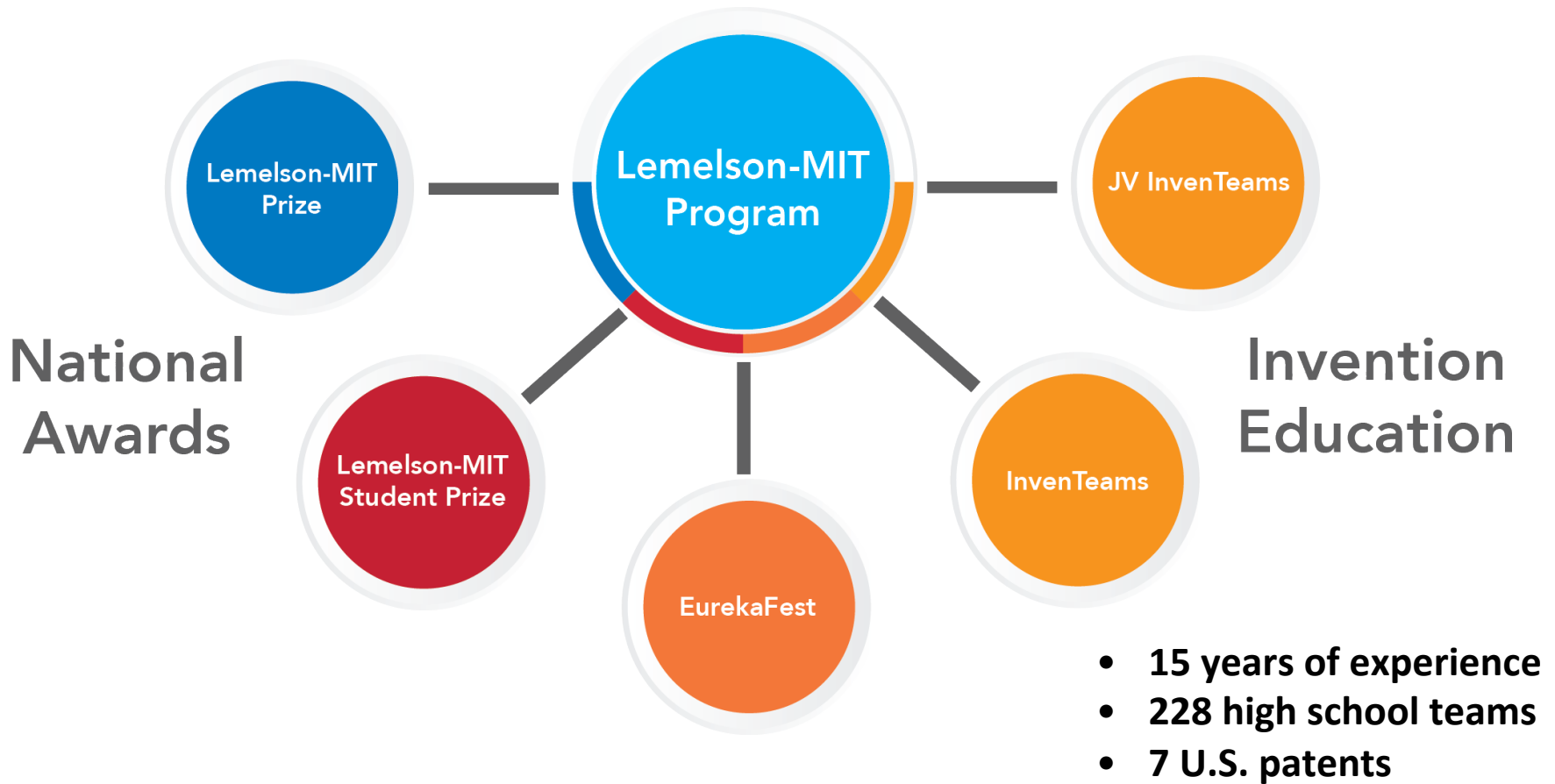
Invention Education
Webinar Series



Thursday, December 14, 2017

6:30 – 7:00 p.m. ET

Lemelson-MIT Program Overview



Presenter Don Domes

- Special Projects in STEAM and CTE for the Office of School Performance, Hillsboro Public School District, Oregon
- Member of the Board of Directors of Oregon Robotics Tournament & Outreach Program
- Retired high school CTE teacher

Lemelson-MIT Invention Education Experience

- Hillsboro High School InvenTeam (2007)
- Self-installed automotive heads-up display
- Master teacher with LMIT for 9 years



Basic Safety Rules for Tool Use



Wear safety glasses.

If you are in doubt about how to use a tool, ask!

Have a plan for what you are going to do with the tool.

Be mindful of others who might enter into your workspace accidentally.

Secure the workpiece.

Have a balanced stance while using a tool.

Remove all jewelry, watches, and loose clothing before working with machinery.

Pin up long hair and wear closed-toe footwear.

Never work when you are tired or unfocused.

Leave the workspace cleaner than you found it.

PVC

- PVC= Polyvinyl chloride
- The world's 3rd most widely produced synthetic plastic polymer
 - 1st is polyethylene used in plastic bags and bottles
 - 2nd is polypropylene used in textiles like fleece & carpet
- PVC is used in construction
 - Plumbing and electrical conduit
 - Available in different diameters, lengths, & strengths



Characteristics of PVC

- High hardness, burst pressure, & strength
 - two forms of PVC: flexible vs. rigid
- Poor heat stability
 - starts to decompose at 140° C (284° F)
 - used for cold water only
- Good electrical insulation
- Chemically resistant to acids, salts, bases, fats and alcohols



Flexible PVC hose pipes

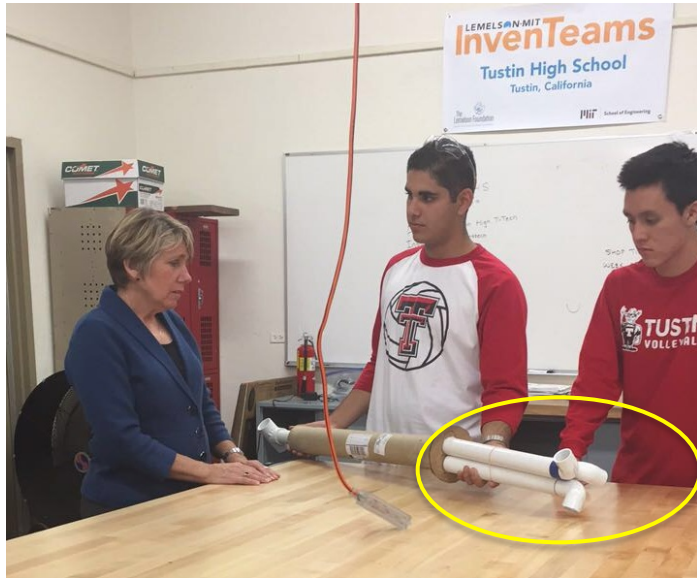


Rigid PVC pipes

PVC is not safe to be used under pressure!!!

Prototyping Inventions with PVC

- Use PVC for prototyping material, not for its intended use for household construction.
- Should consider PVC properties when prototyping!



Original prototype of Tustin High School InvenTeam's Gum Remover was made of cardboard and PVC pipes.

Tools working with PVC

- Safety glasses & dust masks



- PVC Cutting Tools:

- Hacksaw/backsaw
- Scissor/ratchet-style pipe cutter
- Power miter saw (not necessary)



Backsaw/Hacksaw



Ratchet-Style Pipe Cutter



Power Miter Saw

Tools for working with PVC

Tools for holding material taunt for cutting:

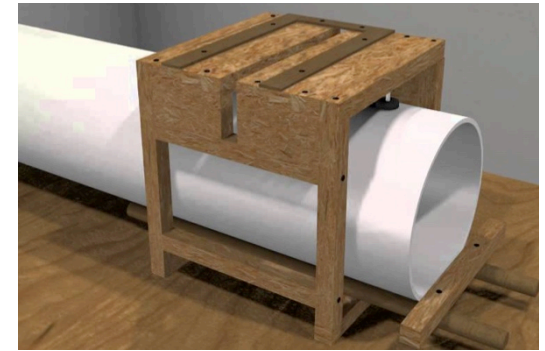
Clamps



Miter boxes



Build a jig

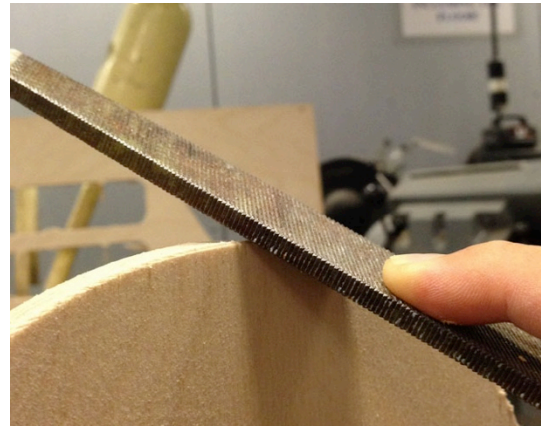


Tools for deburring the cut edge:

Sandpaper (100/120 grit)



File

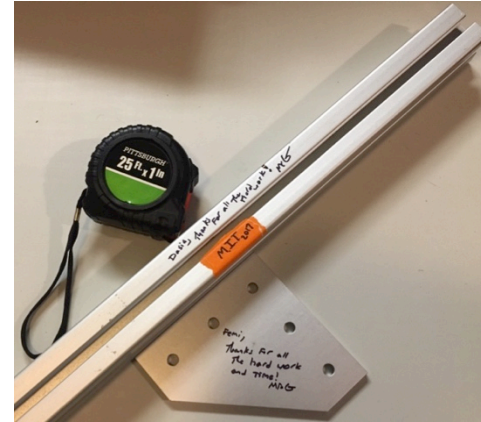


Video on cutting and drilling thin PVC:

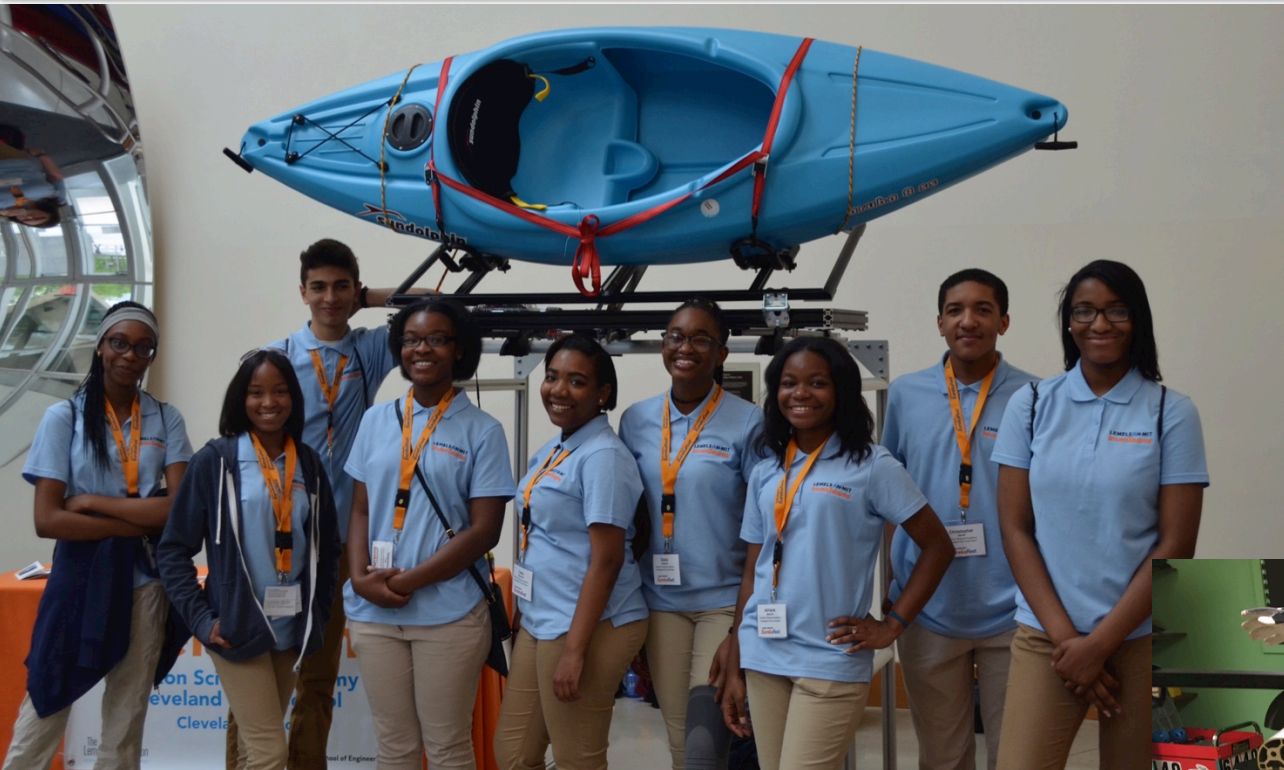
<https://vimeo.com/169788355>

80/20[®] Framing System

- A grown-up version of kids' Erector Set
- A framing system using extruded beams of aluminum alloy with T-slots for assembling.
- Used when making a structure. Most common uses are for enclosures, guards, working stations, and machine structures.



Invention with 80/20[®]



Horizon Science Academy Cleveland
High School InvenTeam 2017
invented a device to lift a kayak onto
a standard car carrier



Tools for working with 80/20®

- Safety glasses
- Gloves
- Dust Mask
- Aluminum Cutting Tools: Hacksaw
- Clamps or jig to hold 80/20 for cutting
- File to deburr the cut edge

Tips for working with 80/20®

- Know your blades!
- Don't use a blade with missing teeth or one that's not straight
- 32-teeth per inch blade are useful for cutting soft metal
- Cut slowly
- Can use powered tools but they are not necessary!

Check out videos on YouTube for working with 80/20:

- Short 80/20 profile video

<https://www.youtube.com/watch?v=YrfhwrlZerk>

- Short video on making a corner

<https://www.youtube.com/watch?v=QP8z9rd2SGI>

Low Cost 80/20 Alternatives?

- Other alternatives can be found in hardware stores.



Lemelson-MIT Resources

- Lemelson-MIT Program
<http://lemelson.mit.edu/>
- InvenTeams National Grants Initiative
<http://lemelson.mit.edu/inventeams>
- JV InvenTeams Curriculum Materials
<http://lemelson.mit.edu/jv-inventeams>
- Inventor Archive
<http://lemelson.mit.edu/search-inventors>

Other Resources

Instructables.com

8020.Net

Books on tools and materials:

[Field Guide to Tools: How to Identify and Use Virtually Every Tool at the Hardware Store](#)

[Exploring Materials: Creative Design For Everyday Objects](#)

[Materials and Design: The Art and Science of Material Selection in Product Design](#)

Q & A

Q: What is a good beginner project for high school students to make with either PVC or 80/20®?

The JV InvenTeam activity guides entitled “Growing Green” and “Pump It Up” include great invention activities using PVC materials to create a hydroponics system and hydraulic pumps. The educators’ guides offer suggestions and tips on how to facilitate these projects and support students’ development of inventive mindsets and skills. The video Don created is for the “Going Green” project (<https://vimeo.com/169788355>). Feel free to check them out!

For students without any previous experience with PVC, they may start with simple projects such as connecting PVC to make water pipes. Check out [the cute cat hammock made out of PVC](#) on the Instructables website. They then can move to a more complex challenge like building a dog house using PVC.

Furniture and shelving are good starter projects to make out of 80/20 or T-slotted extruded aluminum. Check out the 80/20 photo gallery for inspiration!

Q: Where can you buy 80/20® or extruded aluminum?

A great question! There are a variety of places where you can purchase extruded aluminum. You can go to the 80/20 website and get a quote. Amazon even sells 80/20. Grainger (<https://www.grainger.com/>) sells extruded aluminum and has local stores. Make sure you look around and get quotes from multiple stores. Prices may vary from store to store.

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THANK YOU!

Contact Us at
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Invention Education
Webinar Series

