

# LINE MOUNTAIN MIDDLE-HIGH

By: Jared Haas and Joseph Kahl



Student welding in the Introductory Metalworking class.

## TRADITIONAL TECHNOLOGY EDUCATION WITH A MODERN TWIST

The Line Mountain School District is a rural school district located in Herndon, Pennsylvania, which includes one elementary and one middle/high school. Technology education is offered to students in grades 8–12. It is a required course in eighth grade and various elective courses are offered in grades 9–12. The department is made up of two teachers; Jared Haas and Joe Kahl, both graduated in 2012, from Millersville University's Technology Education program. The department has experienced overwhelming administrative support from the high school principal, Jeffery Roadcap, also a Millersville University Industrial Arts graduate, to the superintendent David Campbell, as well as the school board members. The community has also become highly involved with the school's Technology Education Department, even developing a booster organization for them.

## HIGH SCHOOL

The high school offers nine technology education courses for students to choose from as electives. These classes are traditional, but are taught with a modern twist. Classes are offered in Metalworking, Woodworking, Drafting, and Architecture.

### Metalworking

There are three levels of metalworking classes. In the introductory course, students become familiar with hand tools and some basic metalworking equipment such as; sheet metal shear, box and pan break, band saw, drill press, MIG and ARC welders. Some of the projects include: a parallel clamp, sheet metal rose, sheet metal toolbox, and basic lap, T, and butt welds.



Students enrolled in Manufacturing in Metallic Processes class work to finish a wagon wheel bench that is being sold to a community member.

The advanced metallic processes course builds on the introductory level. Emphasis is placed on troubleshooting equipment and real world applications. Students gain experience with the Technological Design Process by designing and building a charcoal grill to specific criteria and constraints. At the conclusion of this project, the grills are tested by having a cookout.

The Manufacturing in Metallic Processes course is a unique course. Students learn about manufacturing processes, then build and sell wagon wheel benches. To date, more than 125 of these benches have been built and sold, some are as far away as Virginia, while others can be spotted on front porches throughout the community. The department has been fortunate enough to have the support of the district's business office throughout the years. Because of this, the profit generated from the production and sale of these benches gets divided among the students in the class and each student is allowed to pick a tool or piece of equipment they would like to get with their share of the money. Last year, each student in the class got to choose tools and equipment that totaled \$350! This allowed several students to purchase tools that were required for the trade schools they planned to enroll in after graduation.

### Woodworking

In addition to the three levels of metal processing courses, Line Mountain offers three levels of non-metallic processing where students mainly

refine their woodworking skills. The level one woodworking class consists of educating the students on design, lumber processing, and basic use of all equipment in the shop. Some of the equipment they use are drill presses, band saws, a jointer, a planer, a panel sander, spindle sanders, lathes, a SawStop table saw, different jig and fixture tables, as well as a laser engraver which is often used to put a design into the projects. One of the focuses at this level is to ensure students are able to accurately and safely use all of the equipment and tools within the lab. Students develop and read blueprints to create projects such as wooden trivets, sanding blocks, jewelry boxes, night stands, and even L.E.D. clocks.

Level two consists of manufacturing processes where the students learn more about design, processing, and utilizing jigs and fixtures to create consistent products in a manufacturing system. During this class, students often work on real-life projects like creating trophies for different school organizations such as the basketball and archery teams.

The third level of non-metallic processing builds on the first two levels and it allows the students to create a project from start to finish utilizing the Technological Design Process. Here they design a project, determine their material requirements, and carry out the process of creating and finishing the project. Design and finishing

are the main focuses during this level as well as continually refining their woodworking skills.

### Drafting

Drafting also consists of three levels. The first level focuses on drafting basics from learning about the equipment needed in hand-drafting, to creating single-view drawings, to utilizing AutoCAD in the development of multi-view drawings. Level two builds upon their previously learned drafting knowledge and focuses on parametric modeling and 3-Dimensional drawings through the use of Autodesk Inventor. Here students learn about modeling and prototyping and work to create both using 3D printers. In level three, students are presented with an opportunity to build a 3D printer using a do-it-yourself kit purchased with the budget. This year we were able to buy Anet A2 printers for this and after the students build it, they are able to create 3D models which they design to solve problems presented to them.

### Architecture

Architecture focuses on the aspect of designing a home as well the different plans involved in architectural blueprints. After learning the basics of home design, students work to develop plans for a dream home of their choosing that fits into their proposed budget. At the completion of their plans, students create a 3D model of their home based on their designs.

## MIDDLE SCHOOL

Up until last year, the eighth grade students were divided into six sections, and on each day of the six day cycle they had a different course. This infrequent meeting schedule was difficult for teachers and students and limited the activities and lessons that could be taught. At the conclusion of last year, the middle school announced a change to a marking period schedule for their special courses. The eighth grade students would be divided into four groups and placed in a "special" for the entire marking period, rotating every 45 school days. An idea was presented to the Middle School Principal, Jeffery Lagerman, to allow the technology education department to split one of these sections in half and divide the students between both teachers, providing a smaller, safer classroom. Mr. Lagerman approved of the idea and allowed the technology education department to redesign the middle school curriculum. Since all students are required to take technology education in middle school, we felt it was important to introduce the technologies available to students in high school courses to provide a broader and more authentic experience.

This year is our first year implementing this new curriculum, and students experience four different mini units, each dealing with a content offered in high school level courses. The first week is composed of safety and measurement, after that, the classes are divided in half. Students get to solder small circuits, design mini houses using architectural software programs, learn how to MIG weld, draw a candy machine on Inventor, print out a working model of it, and create it in the lab.

Eighth grade students have been very excited and vocal about their inter-



Examples of trophies that students in the second level non metallic materials produce for student organizations within the school.

est in continuing courses at the high school level. It is anticipated that this will increase our enrollment in the high school courses. These numbers could lead to expanding the department, which would enable us to provide further course offerings.

### EXTENDED LEARNING

Line Mountain offers a late bus, which provides transportation home for students who participate in sports or other after school activities. This is a great way for students to catch up on work without having to secure a ride home. We offer open lab hours each Tuesday and Wednesday from 2:30 to 5:30pm. There are a number of students who come in each evening to catch up on assigned projects or work on individual projects.

### COMMUNITY INVOLVEMENT

The Technology Education department has also been fortunate enough to have gained the support of the community. A booster club has been developed for the department, allowing for expansion of fundraisers and activities that directly benefit the students in technology education classes.

Each year the Booster Club hosts a car show with all of the proceeds going towards purchasing more equipment for the labs. The students



Tools students received as a result of profits earned in classes with manufacturing projects.

run all aspects of the car show, with the exception of the food. They make banners using the vinyl cutter and each year they design and build the trophies. This car show has become known far beyond the district's borders and continues to grow each year. To date, the booster club has been able to purchase two new MIG welders and powder coat the welding booths that students built, as well as other contributions. These activities allow students to gain experience with the most up-to-date equipment.

This year, the department was also approached by a local family of a former machinist and tool maker, who had recently passed. They wanted to develop a scholarship fund in his name for any student in the technology education department who was going to continue their education in a trade. After months of development, the Stephen Wynn Memorial Scholarship was born.

### CONCLUSION

The Line Mountain School District offers solid Technology Education courses to students in grades 8-12. The curriculum is structured to expose students to traditional materials processing techniques, as well as opportunities to work with up-to-date software and equipment like laser engravers and 3D printers. This blend of traditional and emerging processes works well to provide students with technical skills and provide them with design and manufacturing experiences. We are also fortunate to have strong support from our district administrators and the community. If you are interested in learning more about our program feel free to contact us. We can be reached via email at: Jared Haas at [jhaas@linemountain.com](mailto:jhaas@linemountain.com) and Joe Kahl at [jkahl@linemountain.com](mailto:jkahl@linemountain.com). ■



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# TAKE & MAKE

## MARBLE RUN!

by: Emilie Tekely & Scott Farmer

Marble runs have become popular lately on YouTube and on DIY websites. The company that produces Dyson vacuums even had a marble run design competition. You will be working in a group of up to three students to design, fabricate, and test your own marble run. See an example video at <https://www.youtube.com/watch?v=kwedBdWIRuQ>

### Problem

Design a marble run that takes 30-45 seconds complete from start to finish.

### Limitations & Specifications

- You must get teacher approval on designs before you can have materials.
- Your design must be original. Components of the run might be similar from group to group, but they cannot be in the same order or have the same design.
- The run must be made out of cardboard, cardstock (in limited amounts), and tape
- If you want to use other types of materials, they must be approved by the instructor before you can use them/bring them in.
- You will be able to use scissors and craft knives to cut pieces.
- The run must last for 30-45 seconds.
- No more than three students per group.
- The run must have a name, a theme, and contain at least four theme-related decorations
- The run must include five different marble run components:
  - Straight track
  - Tunnels
  - Curves
  - Steps or drops
  - Jumps
  - Funnels
  - Switches
  - Ramps
  - Hills

	Advanced 10 pts.	Proficient 8-9 pts.	Basic 6-7 pts.	Below Basic below 6 pts.
<b>Functionality the product functions as a marble run.</b>	A marble will roll through the entire run and not get stuck or fall off of the track.	A marble will roll through the track and it will only get stuck once or the marble falls off the track once.	A marble will roll through the track, but it will get stuck and/or fall off the track at least 3 times.	A marble does not stay on the track or gets stuck at least 5 times.
<b>Marble Run Components</b>	5 or 5+ of the suggested marble run components were used in the final product.	4 of the suggested marble run components were used in the final product.	3 of the suggested marble run components were used in the final product.	Less than 3 of the suggested marble run components were used in the final product.
<b>Theme</b>	The marble run had a theme, name and at least 4 decorations included.	The marble run had a theme but no name. It had at least 3 decorations.	The marble run did not have a theme, but it did have a name. The decorations did not related to the name.	There was no apparent theme/ name/decorations.
<b>Time (30-45 seconds)</b>	The marble run lasted for 30-45 seconds (one marble start to finish).	The marble run lasted for 20-29 seconds (one marble start to finish).	The marble run lasted for 15-20 seconds (one marble start to finish).	The marble run lasted for less than 15 seconds (one marble start to finish).
<b>Group Participation</b>	Upon observation, all group members were on task and contributing positively to the project. If devices were used, it was to look up things related to the project.	Upon observation, the group members were on task for a majority of the time and they were contributing positively to the project. Devices were used appropriately. The instructor had to ask one group member to use the devices appropriately.	Upon observation, the group members were often distracted. They did not have forward progress and could not come to an agreement when a decision was needed. Devices seemed to be a distraction and the instructor had ask 2 group members to use their devices appropriately.	Upon observation, not all of the group members were on task. Some were group members did not participate. Devices were used for unrelated reasons, were a distraction to progress, and the instructor had to ask them to put them away.
<b>Total points for Marble Run Prototype= _____ / 50 pts</b>				