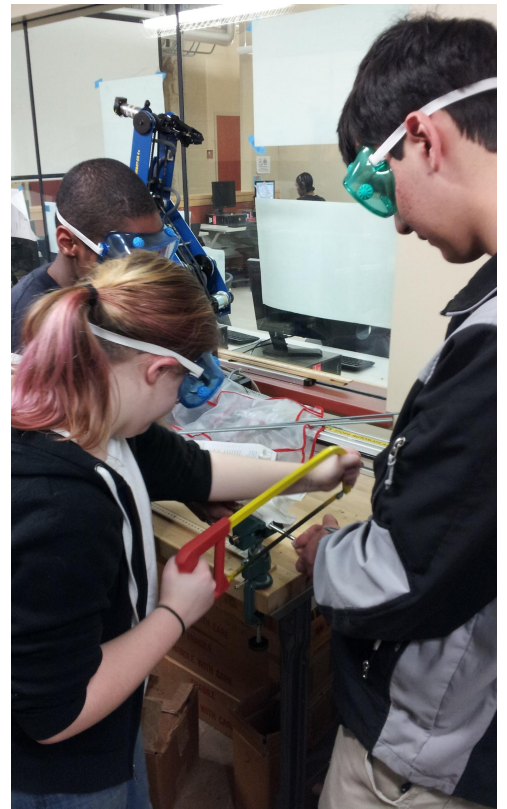


## Building a 3D Printer from Scratch! With Garfield HS Robotics & Projects in CS students

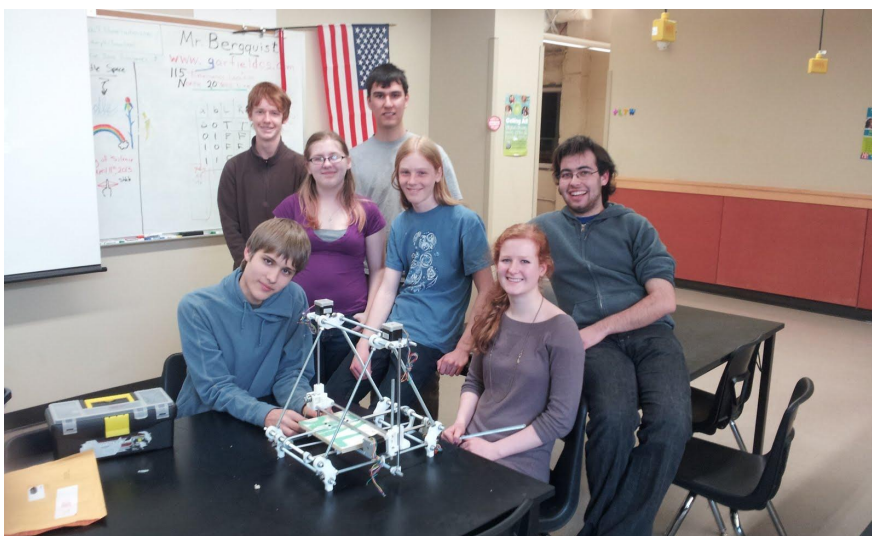
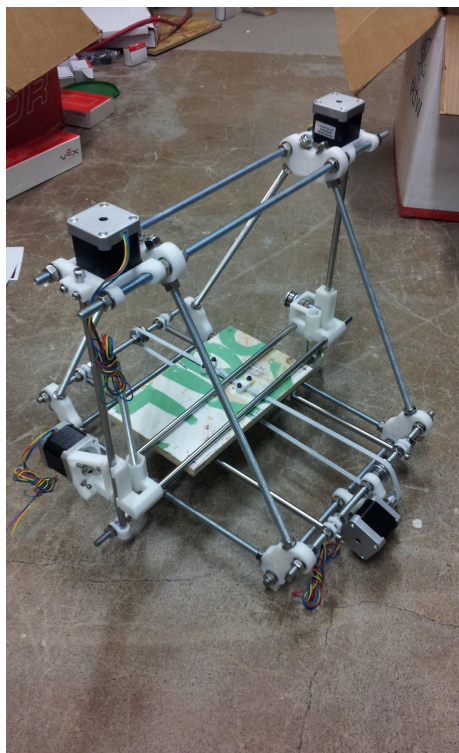
This year in Projects in Computer Science, three outstanding students decided to take on a harrowing task--to create a RepRap Prusa Mendel 3D Printer. Armed with the extensive-but-not-too-helpful wiki pages, the talented mind of Mr. Bergquist, a little help from Robotics Club, and their impressive problem-solving and spatial reasoning skills, Chance, Laura, William, and the robotics team set off on the most important adventure of their lives.



The first step was printing the parts from the [wiki](#). Using our handy-dandy school 3D printer, we were able to print the STL files from that page. The first club meeting was spent gathering the printed parts, cutting rods, and building the frame vertex triangles. This part was pretty straightforward. We just followed the Prusa Mendel [Visual Instructions](#).



## Building a 3D Printer from Scratch! With Garfield HS Robotics & Projects in CS students



We continued to build, mounting the NEMA 17 [Stepper Motors](#) we bought from [XYZ Printers](#). We mounted our print base after scavenging boards from GHS Tech Theatre, and used [pulleys and belts](#) to attach the bed to our y-axis stepper motor. Our stepper motor axles were also too small for our printed couplings, but we solved this by thickening the axles

with tape. When the team attempted to attach the x-carriage and belts, we saw that we would have to assemble the extruder before assembling the x-axis--the biggest challenge we had faced yet.

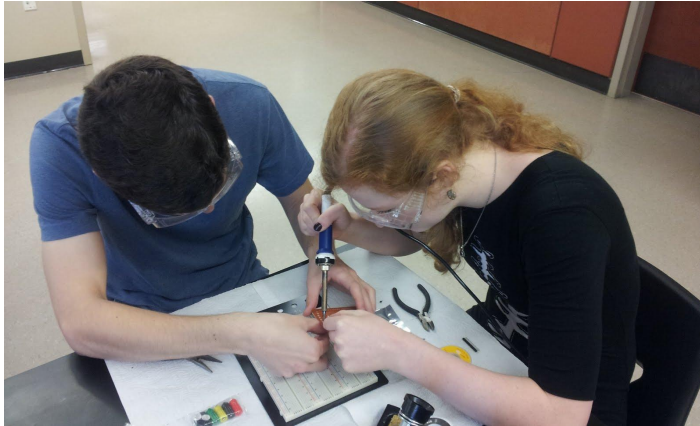


To assemble the extruder, we followed the [Wade's Extruder Instructions](#). We needed to make a hobbled bolt. This consisted of dremeling a notch out of a bolt and then adding parallel ridges to the notch. We also had to acquire springs and rebuild the extruder a few times to make sure there was some give to the feeding of the PLA plastic. We also needed the [Hot End](#) using the [J-Head Build Instructions](#) before mounting the extruder to the x-carriage. This was just simple wiring and kapton tape. After mounting the hot end to the extruder and then the extruder to the x-carriage, we had almost completed our hardware!

Finally, we mounted the top print bed to the bottom print bed with ballpoint pen springs to allow for give. We then wired the [Hot Bed](#) according to the [blog post](#) made by Josef Prusa. We then mounted the bed to the print base and binder-clipped glass to

## Building a 3D Printer from Scratch! With Garfield HS Robotics & Projects in CS students

the top so the printing surface would be level. At this point, we had finished our hardware for the printer!



We still had a lot of electronics to tackle, however, We soldered pins into the [Brainwave](#) board we got from [Metrix](#) and cannibalized a 12V power source from an old dell computer. We were somewhat confused concerning the wiring, however. After taking a trip to Metrix to get the ends of our wires crimped and determining the pairs in our stepper motors, we were ready to go at wiring. At this point, it's not completed, and we have some more

problem-solving to do.



In robotics club, we taught five students how to use the 3D modeling software Autodesk Inventor. Many have been successful in recreating TETRIS parts used for FTC Robotics, and we have designed Tetris blocks to print once the project is up and running. We have high hopes for a functional printer by the end of the year!

### Key Links:

Our Build Page: <http://www.garfieldcs.com/2013/04/building-our-3d-printer-parts-page/>

Prusa Mendel RepRap Wiki Page: [http://reprap.org/wiki/Prusa\\_Mendel\\_\(iteration\\_2\)](http://reprap.org/wiki/Prusa_Mendel_(iteration_2))

Visual Build Instruction Guide: <http://garyhodgson.com/reprap/prusa-mendel-visual-instructions/>

Wade's Extruder: <http://garyhodgson.com/reprap/2011/04/wades-geared-extruder-visual-instructions/>

BrainWave Controller: <http://www.thingiverse.com/thing:25054>