Automotive Technology (AT) programs across the country, like the one at Lyons Township High School (LTHS), teach students the ins and outs of vehicle maintenance and repair. Teachers present students with a set of symptoms on a vehicle (the problem) and the students work through a process of elimination or look up a recommended course of action to determine the correct repair for the vehicle they must fix (the solution).

As students progress through such a program, the challenges move from routine, like changing oil and checking fluids, to pressure testing and replacing brakes, to tearing apart complicated mechanical components like engines or transmissions. All these processes require a vast amount of knowledge and skill. But where does “making” fit into the equation?

LTHS recently added the Automotive Engineering and Fabrication class to its Applied Technology Department, which is within both the AT and Engineering career pathways. This class has the spirit of making embedded within the curriculum. It builds on the principles of the Maker Movement, which is based on taking an idea and bringing it to reality—on your own or with a small group of people—while fostering an entrepreneurial spirit and a desire to create, innovate and discover.

Premise
It’s been quite the process to get the Automotive Engineering and Fabrication class up and running (pun intended). In 2009, Jordan Engelhardt, the teacher who was hired to oversee the AT program, inherited a stagnant program that was headed in the wrong direction. Over time, though, he was able to breathe new life into the program. First, he updated the tools and equipment. Then, he updated the existing courses in the AT program, thus redefining the curriculum.

However, by the time I arrived at LTHS four years later, Engelhardt was looking to add a class to take the program to the next
level—one that was project-based, instead of problem-based, one that would challenge students to think at a deeper level, and lastly, one that equipped students with a new set of skills that not only fostered a pathway to the automotive industry, but also embraced the maker/do-it-yourself mentality.

Two very popular automotive TV shows with instructors in the Applied Technology Department are Fast and Loud and Overhauling, both of which have a heavy emphasis on design and fabrication. Both are also pretty fast-paced; technicians in the shops move quickly as they restore and transform cars into things of beauty. Viewers see skilled technicians and craftsmen working with tools like TIG welders, English wheels, and CNC mills and lathes, etc., which are very different from standard AV tools like wrenches and MIG welders.

After many hours of brainstorming and collaborating, we developed a concept for the class that was based on the need for these skills in the automotive restoration industry, as well as other fabrication industries. We also identified certain skills students would need for this class that were different from other AV classes—the ability to sketch, work with computer-aided drafting (CAD) tools, blueprint reading and reverse engineering, to name a few.

Once the new class was approved, it was added to the AV program.

**Making**

There are projects big and small that are designed throughout the course to build skills embraced in the Maker Movement. For instance, students have reverse engineered a TIG welder tool holder to learn cutting, bead rolling and finishing processes; they have learned MIG and TIG welding, sheet metal cutting, bending and forming, and they have mastered pattern and template creation in preparation for some of the bigger projects.

The penultimate project of the course is restoring a 1929 Ford Model A Tudor Sedan, which is scheduled to be completed by the end of the 2016–2017 school year. A program advisor, who owns a hotrod and chassis shop, is available to help the instructor. He has provided invaluable guidance as we seek to build a course that will challenge students.

This class, and many like it, provide students with the opportunity to learn skills in a controlled and safe environment, with an experienced instructor who can guide them through the skill-building process. Teachers in career and technical education (CTE) classrooms have strong backgrounds in workplace safety, tool use and design, as well as real-world experience—expertise that is often lacking in makerspaces outside the CTE classroom, such as those popping up in public libraries and community makerspaces.

I believe that there is so much more than the Maker Movement and just using digital tools like free CAD software, small desktop 3D printers or laser engraving machines. Those tools merely scratch the surface of truly learning what goes into making something. In classes like Automotive Engineering and Fabrication, students are learning about material selection, manufacturing processes, mocked-up models and proof-of-concept practices. The Maker Movement is how the next generation of manufacturing entrepreneurs will be created (Anderson, 2012), and CTE classrooms are the ideal location for the start of this process.

**STEM Impact**

The Automotive and Engineering Fabrication course is based on an integrated science, technology, engineering and math (STEM) approach. Students acquire knowledge in the mechanical properties of the automotive technology and engineering design industries. Through the process of making they learn how to calculate the level of electrical current needed in welding and feed rates for cutting different types of steel.

Furthermore, the STEM approach helps students discover the physical properties of materials, as well as how to choose the best processes for making parts for their projects. In addition, they are learning about precision measurement and the impact a few thousandths of an inch make in the process of creating a mechanical product. They use design tools to create models and test those models for strength. The STEM model emphasizes the design process, enabling students to identify problems and come up with a new solution, learn from their failed attempts and adopt an engineering mindset.

**The Future**

Why is integrating the Maker mindset into your CTE curriculum important? Because employers in the automotive technology industry, and other similar industries, are looking for people who have a history of making. In the book Elon Musk: Tesla, SpaceX, and the Quest for a Fantastic Future, Dolly Singh, former head of talent acquisition at SpaceX, is quoted as saying: “We were looking for people [who] had been building things since they were little” (p. 221).

Ashlee Vance, the author of the book, goes on to emphasize that SpaceX, a company that, according to its website, “designs, manufactures and launches ad-
As a health care professional and officer on the U.S. Army health care team, you will enjoy a level of leadership development, hands-on training and life experience that sets you apart. Army health care professionals assume advanced roles earlier than their private-sector peers and become experts in their field, while inspiring others to reach their full potential.

Driving It Home
As a result of taking this class, students have participated in and won welding competitions that resulted in more than $9,000 in scholarships. Our ultimate aim for the restoration project is to sell the Ford Model A Tudor Sedan at auction and use the revenue to fund the ACT program. Our students are learning what it takes to go from concept to reality. They are becoming makers.

Jason Hlavacs, Ed.D., is the division chair of applied arts at Lyons Township High School in LaGrange, Illinois. E-mail him at jhlavacs@lths.net.

REFERENCES