

Keeping It Real

A Toledo Public School Prepares Students for College and Career



BY JENNIFER DUBIN

“Why do I have to learn this?” It’s a question that crosses the minds of many high school students, but one that Ian Furstenberg doesn’t need to ask. Because of his classes in such technical fields as digital electronics and automation, he can see the immediate connection between his schoolwork and his career interests; he dreams of becoming an engineer.

Furstenberg attends the Toledo Technology Academy (TTA), a career-tech school within the public school system in Toledo, Ohio. TTA teaches students in grades 7 through 12 using a science, technology, engineering, and math (STEM) curriculum. In addition to the traditional academic subjects of English, history, science, and math, TTA also provides engineering and technology courses, such as those Furstenberg is taking his junior year.

When he graduates from TTA, Furstenberg will leave with a career portfolio, which will include certifications attesting to his technical expertise as well as letters of recommendation from his

teachers and the company that hired him for his school-sponsored internship. If he decides to work right after high school, he can present that portfolio, showcasing his knowledge and skills, to a prospective employer. Or he can submit it to a college admissions office along with the standard application.

It’s a decision Furstenberg will make in the near future, and it’s just as important as the one he made a few years ago to apply to TTA, a magnet school. While 70 percent of the students, like Furstenberg, come from Toledo Public Schools, 30 percent come from surrounding suburban schools. Students enroll because of the school’s reputation for rigorous academic and technical instruction.

Roughly half of TTA students receive free or reduced-price meals, a figure indicating economic challenges at home. But despite coming from low-income families, many students are able to put financial concerns aside and focus on their studies, geared to preparing them for further education or training and future careers. Nearly all students pursue some form of postsecondary education upon high school graduation, and many work while doing so to make ends meet.

Students and teachers engage in hands-on work in engineering and technology fields at the Toledo Technology Academy. The school is a labor-management partnership between Toledo Public Schools and local business and labor leaders.

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The school's emphasis on engineering technology makes sense in a region of the country known for its manufacturing base and ties to the auto industry. The largest city in Northwest Ohio, Toledo is car country. Major employers include a Daimler-Chrysler plant, a Jeep assembly plant, and GM Powertrain, the biggest transmission plant in the world.

Offshoring of manufacturing jobs to China and Mexico as well as the recent recession hit the Toledo area especially hard. But the local economy has begun to rebound. Projections based on data from the Bureau of Labor Statistics show employment growth from 2010 to 2020 for Toledo and its surrounding counties in the following areas: plastics and rubber products manufacturing (3.7 percent), nonmetallic mineral product manufacturing (8.2 percent), and fabricated metal product manufacturing (7.5 percent).

Economic growth in Toledo will require businesses to hire well-trained employees in skilled trades and engineering. To keep such workers from leaving the area and prevent "brain drain" is largely why TTA was created in the first place.

In 1997, the public school system joined with local business and union leaders to establish TTA as a two-year program. In 2002, it became its own school. A governing board, made up of the school district's superintendent, the president of the Toledo Federation of Teachers, the plant manager of GM Powertrain, and the president of the United Auto Workers local, along with 12 other school, business, and labor leaders, meets monthly to help manage the school, whose principal (officially called "director") is a retired GM employee.

The successful labor-management partnership has enabled this school district, which has seen charter and Catholic schools chip away at its enrollment, to retain top students and demonstrate what career and technical education can do for those, like Furstenberg, who thrive on a curriculum that is not entirely abstract. "Being able to go in there and work with my hands," he says enthusiastically, "it's just this fantastic feeling."

"A Particular Kind of Student"

The school that Furstenberg attends actually began as a small program within a traditional high school. In the 1980s, Jerry Ewig, a shop teacher, since retired, started teaching an industrial automation class to juniors and seniors because he was interested in the subject.

To provide students with the necessary tools and expertise, Ewig knocked on the doors of local businesses. Tom Volk, who owns Ohio Belting & Transmission, agreed to help. His company is a distributor for industrial motion-control products, selling parts such as sensors for robots in automotive factories. Volk would visit with students and share his technical knowledge, and he continues to do so today. Later, he would also join TTA's governing board. "It's just the right thing to do," he says of his involvement in the school. "It's good for the community."

Ewig also convinced others, like Oscar Bunch, then the local UAW president, to participate. Bunch then persuaded the plant manager he worked with at GM Powertrain to join the effort. With their help, school district officials and Dal Lawrence, then the president of the local teachers' union, created a governing board to expand Ewig's program into a small high school.

They named it the Toledo Technology Academy and housed it in the district's old Thomas A. DeVilbiss High School, which closed

in 1991. District officials as well as members of the business community retrofitted parts of the huge brick building, which dates to 1932, to accommodate machining equipment for labs. They enrolled close to 50 juniors and eight seniors. Academic teachers would teach traditional subjects, including English, history, science, and math, while technical teachers would teach the fundamentals of automation and materials processing. Though the students and staff were in place, a major problem surfaced early on: the teachers didn't get along.

"We did not see eye to eye," says Dale Price, who has taught math at TTA from the beginning and has spent more than half of his 33-year teaching career there. "We had no common point of reference. We had college degrees in teaching, and they had the technical experience."

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He recalls that he and the other academic faculty members couldn't relate to the technical teachers because "they knew how to do things that we didn't understand." The two groups went through the motions of working together, but the rift between them grew. The director of the school couldn't bridge the faculty's cultural differences and resigned. Various administrators who succeeded her did not know what to do either, and the position became a revolving door.

As they move through each grade, TTA students spend increasing amounts of time in labs working with computers and machines.

In 2004, the governing board hired a new director to unite the school. Gary Thompson was a 34-year veteran of GM, specializing in human resource development. He had years of experience training employees and had successfully brought many labor-management teams together. Thompson had worked his way up in the auto industry, beginning as a floor sweeper at a Chevrolet

factory. Later in his career, he earned his bachelor's and master's degrees by taking classes at night.

Thompson was a 1969 graduate of Irving E. Macomber High School, a vocational school in Toledo no longer in existence. Thompson attended the school after his eighth-grade teacher told him he should work with his hands because he was not "college material."

Thompson never resented the remark. Macomber High School taught him a lot, he says. While the majority of his classmates learned auto mechanics, machining, and electrical work, he studied business and marketing there. Still, the experience made him sensitive to the long-standing divide between the academic and technical worlds, a divide he initially found at TTA.

Thompson's background in labor-management partnerships proved crucial to his success in encouraging academic and technical teachers to collaborate.



To attend TTA, students must apply to the school, have at least a C average, be willing to work hard, and have an interest in science and technology.

His background in facilitating labor-management partnerships at GM proved crucial to his success in encouraging academic and technical teachers to collaborate. He approached his new job the same way he had handled his work in

the auto industry: by listening to others and helping them find common ground. "My whole experience was dealing with adults in the workplace, pulling together effective teams," he says. Once the teachers realized they were on the same team and needed to work together, he knew "they'd be good to go."

The school employs 21 teachers, about half of whom teach traditional academic subjects: English, history, science, and math. The other half teach technical courses in robotics; technical communications such as blueprint reading, technical sketching, and CAD (computer-aided design); electromechanical devices; electronics; fluid power; mechanical power transmission devices; programming; CNC (computer numerical control) machining, welding, and

fabrication; and computer-integrated manufacturing. The heart of the curriculum is a pre-engineering curriculum published by Project Lead the Way, a nonprofit organization that develops STEM programs.

Last year, the governing board decided to expand the school; grades 7 and 8 were added this fall. The change enables a greater number of students to be exposed to TTA's curriculum earlier, which will better prepare them for the high school's rigorous classes and labs. Today, 275 students in grades 7 through 12 attend the school. Beginning in seventh grade, students must take six years of courses in both traditional academic subjects and technical areas.

When he first came to TTA, Thompson broke down barriers by making sure that academic and technical teachers talked to each other daily, asked questions about what their colleagues taught, and looked for ways they could connect and support each other's instruction. He also instituted weekly meetings for the entire faculty to discuss students together and plan lessons.

Thompson explains that technical teachers tend to come from industry. For instance, the TTA staff includes an electrician and a mechanical engineer. "They left jobs where they could make a lot more money," Thompson says. But "they discovered somewhere they had a passion for teaching."

All TTA teachers must apply to work at the school and interview with faculty members and the director. Compared with traditional Toledo public schools, TTA's school day runs an hour longer. Teachers are compensated for the extra time; they earn an additional \$5,000 annually.

Students also must apply to the school. Prospective students must have at least a C average, be willing to work hard, and have an interest in science and technology. They must spend a day shadowing currently enrolled TTA students by sitting in on classes and meeting with teachers. Students and their parents are also required to sign a contract agreeing to abide by the rules of the school.

As students move through the grades, they spend increasing amounts of time working with computers and machines such as mills, lathes, and 3-D printers in the school's labs. They use the equipment for projects and to demonstrate specific competencies for industry certifications they can earn while still in high school.

At TTA, faculty members emphasize the importance of students working together. Team projects are often assigned. The most challenging one is completed senior year, when students work in teams on an engineering project of their choice. They also write a technical paper discussing the project. This paper is usually at least 20 pages long and also counts for a grade in their English class. For the project and the paper, students earn team and individual grades.

Students often enter projects in national competitions. Award-winning ones are featured throughout the school. For instance, a poster detailing a flight simulator created by a team called "The Fly Guys" is showcased in the school's lab so that current students can learn from and be inspired by it. The team's 70-page report, also on display, discusses how the machine they built simulates pitch and roll, and describes the history of flight simulation and the American military's use of it.

In May of their senior year, students spend the entire month in an internship with a local business. By then, seniors have completed all their coursework and no longer attend classes in the school building. About 40 businesses partner with the school to sponsor these internships, which are unpaid and count for a grade.

Thompson says that about 96 percent of the roughly 40 seniors who graduate each year continue in some form of postsecondary education, whether it's at a two- or a four-year college. About half pursue careers in engineering. Some students, who can't afford to attend college or who wish to work right after high school, Thompson helps place in apprenticeships in such fields as electrical work and welding.

It takes a motivated student to choose to enroll in TTA. The school offers no sports, music, dance, or theater opportunities after school. A student can join a sports team or extracurricular group at his or her home school (the neighborhood school he or she would have attended), but with the challenging coursework and the longer school day, few do. However, TTA students can earn a varsity letter in two unusual ways: by participating on the alternative energy team, which builds such vehicles as electric go-carts, or by joining a team that competes in FIRST (For Inspiration and Recognition of Science and Technology) Robotics, a national contest to design and build a robot to certain specifications.

"I get a particular kind of student here," Thompson says, one who is "interested in what we do and willing to work hard."

Putting Engineering Principles into Practice

One February morning in the materials and processing lab, 19 sophomores concentrate on fabricating miniature air motors. Dressed in the school uniform of polo shirts and khaki pants, the students must make nine parts from scratch. They use the lab's two band saws to cut aluminum, its eight lathes to make the motor's rounder parts, and its eight mills to cut the motor's base down to size. Weeks before they had even touched any equipment, they designed their motors using CAD software in the classroom next door.

"I'm going to start working on my flywheel," Furstenberg tells a visitor. "I just finished my base." With his safety goggles pushed back on his head, Furstenberg holds a finished air motor, an exact replica of what everyone is supposed to make, to explain how it works. "You put air through a valve," he says. "The air travels and turns the piston," and "the flywheel is able to generate energy." The project enables students to learn the basic principles of pneumatics and make a piece of machinery that runs.

Furstenberg and his classmates stand at machines and periodically refer to sheets of paper outlining the standard operating procedure for the parts they are working on that day. Their teacher, Marvin Gladieux, walks around answering questions and making suggestions. He will grade not only the finished air motor but each part they make. Students will also give themselves a grade.

"I want you to move closer to the line," Gladieux tells a student, standing at a lathe to make parts for his flywheel. "See the edge of your cutter."

"Mr. Gladieux, I need your help," Cesar Hechabarría calls out over the machine buzz.

"Be right with you," Gladieux says.

A minute later, he walks over to Hechabarría, who is making the base for his air motor by using a device called an edge finder. A sign on the wall above him reads: "Measure Twice. Cut Once."

Hechabarría is having trouble centering his base to drill a hole in the middle. So Gladieux reminds him how to read the numbers on the edge finder's screen and line up the part.

During the 50-minute lab, no one sits down or plays around.

Students respect the equipment, which can spin up to 4,000 rpms. In the beginning of the year, they received training on each machine. When the class ends, they clean up just as carefully as they worked. They sweep the floors, store materials, and wash their hands at a large sink by the door.

Gladieux, a technical faculty member, teaches engineering courses to freshmen and sophomores. He has worked at TTA for 17 years but has officially taught for only four. He helped retrofit the building when the school opened and served as TTA's mechanical specialist, repairing equipment and occasionally working with students, until his position was eliminated due to budget cuts.

That's when he decided to pursue teaching. Gladieux earned his teacher certification at the University of Toledo, and he has also taken several education and technical courses at the local community college. Before teaching, he spent most of his career as a

About 40 businesses partner with the school to sponsor internships, which are unpaid and count for a grade.



millwright, after a four-year apprenticeship, and once worked for the local power company, Toledo Edison.

Gladieux enjoys working with students and "seeing the 'aha' moments," he says. He recognizes the importance of teaching them how to translate engineering theory into practice. Coming from industry, Gladieux has worked with some engineers who don't see the practical implications of their work, who "would design things that were impossible to make," he says. "Or they would tell you to turn left three times instead of just turning right once." With projects like making an air motor, he hopes students can learn to avoid similar mistakes. He also hopes they learn that hard work pays off. "When they see their air motor running, they get the biggest smile," he says.

Furstenberg relishes the opportunity to work with his hands. "It's not like you go to a store and you buy an air motor," he says.

Marvin Gladieux, right, with a student. Before teaching materials and processing at TTA, he spent most of his career as a millwright.

“This is something you make yourself. It’s not just a piece of paper with a grade on it.”

From an early age, Furstenberg played with Legos and his computer in his spare time. He wasn’t interested in sports, and social events at school never appealed to him. So when he reached eighth grade, he knew that for ninth grade he wanted to attend TTA.

Furstenberg hopes to pursue a career in a nanotechnology field for engineering. He has passed Algebra I, geometry, Algebra II, and pre-calculus since coming to the school as a freshman. By February of his sophomore year, he has moved on to AP calculus, which he finds challenging. Even with TTA’s rigorous courses, he still makes time to participate on the school’s FIRST Robotics team. And he is grateful that Dana Holding Corporation, a locally based company that supplies powertrain parts, sponsors the team. Dana helps offset the cost of robotics competitions and encourages employees to advise the team on its work. “It makes me really happy that they would take their own time off to come and help a bunch of high school students,” Furstenberg says.

Learning to Connect and Communicate

That kind of connection between local businesses and the school community is exactly what the governing board envisioned. Industry partners volunteer to share their knowledge and expertise so that teachers can expose students to the latest technologies and tweak the curriculum. And just as important, these partners provide internships for seniors.



Joseph Neyhart, left, gained work experience at GM Powertrain during his internship.

GM Powertrain has had such good experiences with the internship program that last year it asked the school to send six interns at the beginning of the school year. Those students, who were seniors, spent nearly half of every school day at the plant until May, when they spent the month there.

TTA graduate Joseph Neyhart, now a freshman at Kettering University, was one of them. He spent his internship, which he also turned into his senior project, working with two other students on designing what they called a “mobile office” for GM Powertrain team leaders. GM devised the project and requested the students’ help. “We actually have [students] working on engineering projects for us, meaningful projects that will help

advance the purposes of this plant,” says Joe Choate, the plant manager at GM Powertrain, which employs 2,000 people.

Neyhart explains that the mobile office combines a toolbox, a desk, and a workstation, all in one, to improve ergonomic conditions on the shop floor, increase productivity of the plant’s team leaders, and save the company money. It also allows team leaders to digitize their paperwork. For security, he and his teammates inserted a thumb scanner so only authorized employees can have access.

Neyhart values his time at GM and in his labs at school. “You get experience versus just lectures,” he says. “We learned how things work.”

Choate, a member of the TTA governing board, says each year his plant hires four or five TTA alumni, after they have graduated from college with engineering degrees. These engineers help design the plant’s machining and assembly processes and the tools to operate them. At GM, Choate says, salaries for these positions start at more than \$70,000 a year.

He adds that TTA graduates can work at GM before they attend college or while they pursue their degree. Jobs that don’t require college degrees pay roughly \$17 an hour and include maintaining and assembling plant equipment. TTA students, Choate says, “are actually quicker at picking things up than the normal new hire would be.”

Volk, of Ohio Belting & Transmission, also employs TTA graduates; three alumni currently work for his 10-person company. All three interned for him while they attended TTA, and they now work in his customer service department. These employees help manufacturing companies determine what kinds of engineering products they need. Volk says that knowledge of how things move, how to control an electric motor, and how sensors work are prerequisites for these positions. TTA students have this knowledge because the school exposes them “to all those products and processes,” which “gives them a huge leg up when they come into an industrial job like this.”

TTA also prepares students to communicate. Volk says that because of their coursework and internships, students know how to write and give presentations. He credits such strong communication skills to the fact that academic and technical teachers work together to integrate their classes and also emphasize the importance of putting technical know-how into words.

For 14 years, Louise Lowenstein helped TTA students communicate their technical knowledge. Although the English teacher retired at the end of last year, her successor is picking up where she left off: teaching American literature, taking students to the local art museum, and editing and grading lab reports as well as senior engineering papers. Last year, for the first time, seniors were also required to create a manual of operating instructions to accompany their project so that, as Lowenstein says, even an English teacher could work it.

Lowenstein taught in the Toledo public school system for 28 years and came to TTA because she wanted to work closely with technical teachers. “I probably should have been one of them, if I had been in a different generation,” she says. “I’m fascinated by how things work.”

Because Lowenstein loves learning about technology, she especially enjoyed partnering with Deb Carper, a former electrician who teaches automation. Last spring, she and Carper won a

\$500 grant to purchase a Tesla coil, a transformer that produces high-frequency power, for a unit on alternating current. In Carper's lab, students did a series of experiments with the coil. In Lowenstein's class, they wrote three- to five-page lab reports about their work. Lowenstein also visited Carper's class to see the coil and the experiments for herself.

Carper reciprocates her colleague's interest. She has observed Lowenstein's classes and has often joined their periodic trips to the Toledo Museum of Art. In February, for instance, Carper tagged along when Lowenstein took the juniors to visit the museum's exhibit on the Tuileries Garden in Paris.

Lowenstein believes that such collaboration benefits all students and their learning. "We're modeling for them what it's really like to work in the workplace with colleagues," she says. Students see that "we care about what the other teacher is doing, so it's not them against us, not my department, your department. It's our school."

Because of their coursework and internships, students know how to write and give presentations.

Aside from extending students' learning in their technical classes, Lowenstein also exposed students to great literature. Her students read *Beowulf*, *Frankenstein*, and Shakespearean plays, among other classics; texts about the Puritans and the American Revolution; and more modern works such as the play *A Raisin in the Sun*, by Lorraine Hansberry, and the nonfiction book *The Devil in the White City*, by Erik Larson. Lowenstein says it's important for all students, including those interested in STEM fields, "to have a core knowledge of what makes American literature what it is, the values that we express that way."

Reading literature also teaches students the power of language. Lowenstein tried to emphasize the importance of harnessing that power as well as the practical need to communicate ideas in the best possible way. "Knowing how to build something will get you a good job," she recalls telling them. "Knowing how to sell it to somebody, and explaining it, will get you a *very* good job."

The careers TTA alumni pursue often involve engineering and technology, but not always. Graduates have enrolled in nursing school and early childhood education programs.

About 32 percent of TTA students are female. Thompson, TTA's director, says the school needs more young women and aggressively tries to recruit them. The female students who do attend are strong technically and very focused academically, he says. "They know what they're doing."

In fact, both the valedictorian and salutatorian for the graduating class of 2014 were female. At least four other young women have also been valedictorians at the school in recent years.

Lauren Holder, 2014's salutatorian, is a freshman in the honors college at the University of Toledo. She plans to pursue a double major in business and accounting, and hopes to open her own business one day.

Holder was homeschooled by her mother from grades 2 through 8. She applied to TTA for its small size and strong reputation, and because it fit with her interest in science and math.



Being female made no difference in her experience at the school, she says. "There are a lot more guys, but I don't really feel like people look at you differently because you're a girl." Male or female, succeeding at TTA takes self-discipline. "It's up to you what you want to be and how far you want to go at this school," she says. "If you're really dedicated, then you're going to go far."

At TTA, few have come as far as Brittany Oldaker. Even after she became pregnant as a freshman, she decided not to drop out. Every day that year, she continued to walk the mile from her home to school, although she was tired and the pregnancy made her physically uncomfortable. She was determined not to give up on her studies or herself. In the weeks before she delivered her daughter, Kayla, now 2, Oldaker earned an A on every exam and maintained a 3.7 grade point average for the year.

Oldaker, a junior when we talked, especially enjoyed her digital electronics class. "I like wiring things," she said. "I like seeing how things turn out."

She was already looking forward to her future beyond TTA. After high school, she wanted to land a job, perhaps with the company where she planned to work as an intern during her senior year. She knew she couldn't afford to attend college full time, but taking classes part time at Owens Community College would allow her to continue her education. Since TTA has an arrangement with local colleges, including Owens, in which TTA labs count as college credit, Oldaker estimated she could save herself nearly \$2,000 in tuition. After a couple years of working full time and taking classes at Owens, she aimed to finish her undergraduate degree in engineering at the University of Toledo.

"It's simple," Oldaker said of her plan. "But it still provides me and my child a good future." □

About 32 percent of TTA's 275 students are female, like Lauren Holder, above. The school aggressively tries to recruit young women.