

# A New Type of School Teaches Skills for the Future



## AT-A-GLANCE

### Background

In Ypsilanti, Michigan, when school officials were searching for innovative ways to engage high school students in math and sciences, they based an entire high school on the *FIRST*® philosophy.

### Bringing STEM to Ypsilanti

The Ypsilanti STEMM Middle College incorporates the *FIRST* emphasis on hands-on, problem-solving engineering and manufacturing skills into an innovative curriculum that provides students with exposure to college academic courses while still in high school. Grizzly Robotics, the school's robust extracurricular *FIRST*® Robotics Competition program, reinforces these skills in a fun, engaging way.

### Enabling vulnerable youth to succeed

Together, the programs are enabling students to succeed. Daily attendance is up from 84 percent to 92 percent, graduation rates have soared from 69 percent to 97 percent, and suspensions have plummeted from 35 percent to the low single digits. The school has also significantly improved the percentage of students meeting proficiency level in science on the Michigan Merit Exam. A combination of high expectations, discipline, mentoring, and kindness have worked powerfully on young people in Grizzly Robotics, some of whom have faced unstable home lives and other challenges to success.

## Ypsilanti STEMM Middle College and Grizzly Robotics

In Ypsilanti, Michigan, when school officials were searching for innovative ways to engage high school students in math and sciences, they based an entire high school on the *FIRST*® philosophy. Now all students at the Ypsilanti STEMM (Science, Technology, Engineering, Mathematics, and Manufacturing) Middle College get a grounding in hands-on, problem-solving engineering and manufacturing skills and exposure to college academic courses while still in high school. Grizzly Robotics, the school's robust extracurricular *FIRST*® Robotics Competition program, reinforces these skills in a fun, engaging way. Together, the programs are enabling students to succeed, and attendance, graduation, and suspension rates have improved dramatically.

## About Ypsilanti

Ypsilanti, Michigan, is a racially diverse, predominantly middle- and lower-middle class community just west of Ann Arbor. Though unemployment is in line with national averages at 5.2 percent, income lags, with about a third of individuals below the poverty level. The median household in Ypsilanti earns just over \$31,000, versus a national average of about \$54,000. Crime rates are well above average compared to both Michigan and the United States as a whole; 10.48 per 1,000 residents are victims of a violent crime each year, versus 4.16 for the State of Michigan and 3.8 for the entire country.<sup>1, 2</sup>

An area with a long history in the automotive industry, Ypsilanti was the birthplace of Apex Motors' ACE car in the 1920s, as well as the innovative Tucker '48 automobiles memorialized in the Francis Ford Coppola film "Tucker: The Man and His Dreams." General Motors housed its Powertrain division at Ypsilanti's Willow Run plant from 1953 to 2010, when it ceased production.

Yet despite this heritage, and like many other Michigan communities, Ypsilanti is feeling the impact of globalization, automation, and other macro-economic trends in the erosion of its manufacturing base. Still, there are signs that cutting-edge applications in robotics and engineering may generate future growth. In 2017, the Department of Transportation picked Ypsilanti's disused Willow Run plant as one of ten sites for a national proving ground for self-driving automotive technology.<sup>3</sup>

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– SCOTT HEISTER, *FIRST* MENTOR,  
YPSILANTI STEMM MIDDLE COLLEGE  
ACADEMIC DIRECTOR

## A new STEM school embraces *FIRST*® ideals

Ypsilanti’s public schools face the same challenges as many others — limited funding, pressure to achieve on standardized testing, competition from charter and private institutions, and declining enrollment. More than 70 percent of the district’s students are from economically disadvantaged families and qualify for free or reduced lunch. In 2014, the school district consolidated and reorganized its high school system, in the process creating a new five-year program called Ypsilanti STEMM Middle College. The school shares a building with Ypsilanti AC Tech High School. “The goal was to inspire students to pursue their education and careers in STEM,” said Sharon Lee, president of the Ypsilanti Community School Board. “It is a program that allows students to earn college credits while obtaining their high school diploma. Most of these students are first generation college students. So, that’s the impact that the program has: It enables them to earn college credits.”

The idea for Ypsilanti STEMM Middle College grew out of work with Ypsilanti’s *FIRST*® Robotics Competition Team 66. The mission of *FIRST* (For Inspiration and Recognition of Science and Technology) is to show students of every age that science, technology, and problem solving are not only fun and rewarding, but are proven paths to successful careers and a bright future.

Scott Heister, the academic director of the Ypsilanti STEMM Middle College, is the lead mentor for Grizzly Robotics’ two *FIRST* Robotics Competition teams (Team 66 and Team 470). He has been a mentor for Team 66 for more than 20 years. “If I were to have one wish, it would be that schools would get *FIRST* as more than just an athletic team or after-school activity – that it really becomes infused in how they do business,” says Heister.

Heister understands that not all kids at Ypsilanti STEMM Middle College can participate in competitive robotics — currently about a third of the student body participates on one of its teams — but they can all benefit from exposure to the process. “Even though we don’t have 100 percent of our kids participate in the robotics teams, 100 percent of our students do engineering projects and utilize the manufacturing equipment,” he explains.

Required manufacturing and engineering classes are taught through challenges where students must design a solution to a specific problem posed by the teacher. Within an A/B schedule, students have long classes suited to project development. Their academic work in math, physics, and other disciplines is aligned with what they are practicing in the hands-on classes.

“Take what you think school is, and turn it on its head,” said student Diana Bernal-Canseco in a 2016 TEDx Talk video about the Ypsilanti STEMM Middle College. “We don’t just sit in classrooms doing busy work, but rather connect to a friendly learning environment that encourages me to work with others, building, designing, and doing teamwork activities.”<sup>4</sup>

For instance, says Heister, “In our ninth-grade engineering class, the last project of the year is building LEGO® MINDSTORMS® NXT robots. Students learn simple programming to allow the robot to use different sensors.” Unfortunately, most of his students don’t have access to the *FIRST*® LEGO® League program in elementary and middle school, Heister explains, “So we expose our kids to robotics as freshmen in their engineering class.”

The combination of the Ypsilanti STEMM Middle College and the Grizzly Robotics *FIRST* program, Lee says, “Inspires students to engage in their learning in a hands-on way. We’ve seen that attendance went up, students started working harder, and their grades improved.”



Students work on a robot at Ypsilanti STEMM Middle College, in Ypsilanti, Michigan.

## STUDENT SPOTLIGHT

### Dalton Smith: Finding Stability, Pursuing Excellence



Dalton Smith, 16, is currently the valedictorian of the incoming Ypsilanti STEMM Middle College's junior class. He speaks confidently about enrolling in college classes as a

sophomore – a year ahead of the typical schedule – and dreams about a job in computer programming. But until a few years ago, Smith's life was very different and a lot less hopeful. He credits the STEMM Middle College and *FIRST* for changing his trajectory.

Dalton grew up in Alabama. His parents divorced in 2007, and his dad disappeared, leaving Dalton and his little sister with a single mother struggling with addiction. "We always moved from place to place, going from friend's house to friend's house, even to strangers' houses, until we got kicked out and had to move again," he remembers. A church helped them move to Michigan, but the situation with his family didn't improve. Eventually, Dalton left the household and moved in with his grandfather.

"From that point on, I decided to try. No one in my family had ever gotten a degree. I believe only two people in my family have passed high school. I decided I want to make a living and forego the troubles of my family," he said.

Dalton researched schools for his upcoming first year of high school and found the Ypsilanti STEMM Middle College. Once at the school, he joined the robotics program to hone his programming skills. By sophomore year he was co-leading the programming team and driving a robot. "It was stressful, but in a good way," he said.

Dalton entered the Ypsilanti STEMM Middle College with a C average. He now has a 3.967 GPA, the highest in his class. He faced additional challenges when his grandfather passed away in 2017, but he hopes to live with a cousin and continue with his studies and the robotics program. Asked what he would tell his 13-year-old self about the future, he says, "I would tell him about the *FIRST* robotics program. I would tell him that it will change your life. It will teach you how to live."

## A direct pipeline to higher education

The school also builds a direct pipeline to higher education through its innovative dual enrollment structure. Students spend three to four years on campus at the high school, taking a combination of general academic, manufacturing, and STEM-related classes. Then in their final one to two years, students are enrolled in college classes at Ann Arbor's Washtenaw Community College, earning up to 80 credits towards a college degree.

Ypsilanti STEMM Middle College accepts all applicants eligible to enroll in community college courses, regardless of grades or previous disciplinary problems. "We're not cherry-picking kids," says Heister. When the current freshman class was tested in eighth grade, no students were proficient in math.

### IMPACT OF NEW SCHOOL ON STUDENT SUCCESS

	2013-2014 school year (Before Ypsilanti STEMM Middle College)	2015-2016 school year (After Ypsilanti STEMM Middle College)
Graduation rate	69%	97%
Attendance rate	84%	92%
Suspension rate	35%	Less than 6%

Source: Ypsilanti STEMM Middle College

### IMPACT OF NEW CURRICULUM ON STANDARDIZED TEST SCORES

Percentage of Ypsilanti STEMM Middle College students meeting benchmarks

	2016	2017
SAT Math	2.90%	15.40%
Michigan Merit Exam Science	11.80%	34.80%

Source: Ypsilanti STEMM Middle College

Yet the school has had a transformative effect. The graduation rate for Ypsilanti STEMM Middle College is now 97 percent, versus 69 percent for the traditional high school it replaced. Standardized test scores are on the rise, too. On the state science exam, the percentage of students who tested at or above the proficient level rose from 11.8 percent for juniors tested in 2016 to 34.8 percent for juniors tested in 2017 – the first group to go through the new curriculum.

Plus, 96 percent of this year's seniors say that they want to go into engineering or another STEM field when they graduate. Students share stories of turning their lives around after the death of parents, family illnesses, homelessness, abuse, and the deportation of family members because of the school and the robotics program. Most now plan to go to college, often as the first members of their families to do so.

"*FIRST* made me a lot more focused and broadened my perspective on things," says Dalton Smith, who overcame a troubled home life to become the top student in his class at Ypsilanti STEMM Middle College (see sidebar, Dalton Smith). "Before I was just looking to get through life, to do the bare minimum. But *FIRST* encouraged me to do my best."

Moreover, the school's success has begun to draw back some of the higher-income families that had abandoned Ypsilanti public schools. Heister says that about 7 percent of next year's incoming class are kids who previously enrolled in charter schools.

## A built-in robotics program poised for success

The Ypsilanti STEMM Middle College builds on the success of *FIRST* in engaging and motivating students. It has also contributed to the growth and success of Grizzly Robotics. Before, at the old school, Team 66 might attract seven or eight participants. Now, between the two *FIRST* Robotics Competition teams, over 50 students are involved in *FIRST* – and they come to the program with greater knowledge and experience.

## STUDENT SPOTLIGHT

### Jawann Odumodu: From Chronic Suspensions to Building a Satellite



Last year, Jawann Odumodu, now 17, had more suspensions than any other student at the Ypsilanti STEM Middle College. Devastated by his father's death that year, which happened

on his birthday, Jawann drifted along – skipping classes, not doing homework, and getting into constant trouble. “It wasn’t like I wasn’t interested. I just was finding it hard paying attention,” he says. “But Mr. Heister kept telling me about robotics. He wanted me to join. He said it could help me.”

By joining the team, Jawann also signed up for an after-school program where mentors supervised as team members finished their daily homework. Jawann thrived in an atmosphere of positive attention. “What I really liked about *FIRST* is that no matter how you’re doing, you’re always proud of yourself,” he says. “They always make you feel happy, that you’re welcome.” His grades improved. From last year’s GPA of less than 1.0, he has moved up to a 3.0 average. He routinely earns As and Bs now.

Plus, Jawann’s interest in robotics caught fire. When the University of Michigan asked Ypsilanti to construct a satellite prototype, Jawann and Orlando Garrett, 16, were selected to build it. “It was hard. We spent hours and hours and even our whole spring break at the school every day,” says Jawann.

A year ago, Jawann could hardly imagine a life for himself. Now, he looks forward to seeing a satellite he helped build launched into space. Next year, he’ll be enrolled in college courses. He’s still trying to decide whether he wants to pursue his original dream of studying medicine or a career in robotics. And this summer, for the first time ever, he got to fly in an airplane to a *FIRST* event in Washington, D.C.

It’s a dramatic turnaround. “Last year, it was really, really hard because my father had died. I even stopped coming to school for a long period of time,” Jawann says. “Mr. Heister kept trying to work on me. I wasn’t listening. I was like, ‘I don’t care, I don’t care.’ But I still try to keep a smile on my face, till today. I’m happy I’m here right now.”



*Grizzly Robotics students work in the machine shop at Ypsilanti STEM Middle College.*

Wilmer Zhinin, a *FIRST* team captain currently enrolled at Ypsilanti STEM Middle College, says students who join the team already know how to use the workshop’s machines and tools safely because they learned it in class. “It saves time and it also helps to expand upon what you can do. You get more stuff built,” he said.

That broader base of knowledgeable, skilled, enthusiastic students has powered dramatic success for Team 66. In 2016 and 2017, Team 66 received the prestigious *FIRST* Robotics Competition Michigan State Championship Chairman’s Award, honoring the team that best represents a model for other teams to emulate and best embodies the purpose and goals of *FIRST*.

## Partnerships with schools and businesses

*FIRST* and the Ypsilanti STEM Middle College program connect students from low-income households with the kinds of advantages that often go to wealthier kids, including internships, contact with business and government leaders, and opportunities for public speaking and intensive learning.

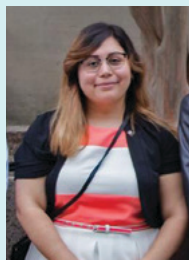
“Our students go out and present on a regular basis to a variety of companies,” says Heister. Students were involved, for instance, in a two-year long campaign to enlist ZF TRW, an American subsidiary of the German-based electronics conglomerate ZF, as a *FIRST* team sponsor. “Two years ago, ZF TRW was not sponsoring any teams. We presented to them, then came back and talked to them a second time, came back again with another team, and then shortly after that, they sponsored us. This year they sponsored several Michigan teams,” says Heister.

In addition to ZF TRW, Grizzly Robotics is also sponsored by General Motors, the State of Michigan, Chartwells, Ypsilanti Community Schools, Ann Arbor-based Soar Technology, and Zingerman’s, among others in the community. When the teams qualified for the Michigan State Championship and *FIRST* Championship, they received additional State of Michigan grant funding, which was used to defray travel expenses.

The Ypsilanti program also has strong relationships with nearby Eastern Michigan University and the University of Michigan, both of which have provided internships for students. But perhaps the most remarkable partnership to date was with the University of Michigan’s Michigan Bicentennial Archive (M-BARC) team, which asked Team 66 to build a prototype of a satellite. In August 2016, Grizzly Robotics, the STEM Middle College, and M-BARC entered into a three-year partnership as a part of the United Launch Alliance CubeSat Grant.

## STUDENT SPOTLIGHT

### Kayse Herrera: A Place to Belong



When Kayse Herrera, 16, was in fourth grade, her mom was deported, throwing her family into turmoil and her own young self into depression and uncertainty. Her mom was able to return eventually, but

Kayse was never able to shake the feeling that her life was fundamentally unsafe.

"A year and a half ago, I couldn't look into crowds and not panic," she says. "I was always panicking when I had to talk to people I don't know, because I don't know how to do that."

Even at her lowest point, though, Kayse was interested in science. She enrolled in the Ypsilanti STEMM Middle College as a freshman and immediately found a place where she felt comfortable. "What I like about the school is that it makes me feel like I belong," says Kayse. "It gave me the feeling that for once I found a place where I felt safe. It helped me discover who I am and who I want to be."

Kayse joined the robotics team, making friends and learning how to communicate – even with the strangers who had previously scared her. Today she dreams of becoming a genetics engineer and fully intends to go to a four-year college.

Asked what she would tell students who found themselves in a similar dark place, Kayse says, "I would tell them to not give up. Even if they do give up, to not give the last bit of hope up. Because I've been there. Hope has run out for me at times, but at the same time, a small piece of hope, I never let go. So it's the fight."

She adds, "*FIRST* is phenomenal. It helps you. Even if you're in the deepest place, even if you're on your last ray of hope, it'll help you."

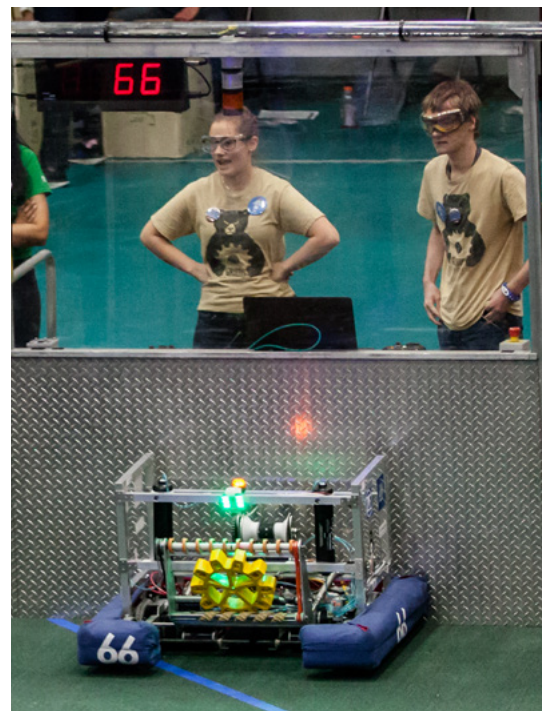
Through the CubeSat program, universities compete for the opportunity to build miniaturized CubeSat satellites for launch on Atlas V space missions. Universities are encouraged to work with elementary and high schools to extend the learning opportunity to younger students in their communities. University of Michigan won a CubeSat slot and selected Team 66 as its partner. Members of the team have been involved in assembling a prototype of a satellite intended for launch with a time capsule celebrating the University's 200-year anniversary (see sidebar, page 4, Jawann Odumodu).

## Tackling the challenges facing vulnerable youth

The achievements of Ypsilanti STEMM Middle College and Grizzly Robotics are particularly impressive because of the kids who are succeeding – kids who, from an early age, face challenges most young people will never confront, including absent parents, drug addiction, homelessness, illness, abuse, and deportation (see sidebar, Kayse Herrera). Even in the most functional, supportive households, expectations are often modest; many of the students never considered going to college before joining the program.

"This is an area where, if you don't have somewhere to go after school, you find some kind of trouble to get into," says Tommy Means, a *FIRST* mentor and coach. "*FIRST* goes beyond that, teaching them about engineering and how to apply the math and sciences that you learn in school to real life situations. It's one of a kind."

"The kids are more of an inspiration to myself and other adults on the team than they realize," Means adds. "It's very gratifying to see the struggles that we know they've gone through and where they're at now."



Members of the Team 66 drive team prepare to play a match at a *FIRST* Robotics Competition event.

- 1 Ypsilanti, MI Crime Rates, Neighborhood Scout, 2017. <https://www.neighborhoodscout.com/mi/ypsilanti/crime>
- 2 Ypsilanti, Michigan Economy, Sperling's Best Placed, 2017. <http://www.bestplaces.net/economy/city/michigan/ypsilanti>
- 3 "Feds Pick Willow Run Site for Self-Driving Designation," Detroit Free Press, January 17, 2017.
- 4 "Robots in the Classroom," TEDx Talks <https://www.youtube.com/watch?v=5iDBpzuewUY>