INTRODUCTION

Since the launch of the Pathways to Prosperity Network in 2012, a national career pathways movement has coalesced and Network states and regions are gaining traction in the work of building out grade 9-14 career pathways. In the fall of 2014, in order to develop a more complete picture of the progress that states and regions in the Network have made—and of the challenges that remain—the JFF team asked regions in the Network to consider whether they were far enough along in implementing the Pathways to Prosperity design to serve as proof points for the Network.

Over the last year, JFF worked with three proof point sites—Long Beach, CA, Central Ohio, and Marlborough, MA—to strengthen their work on Pathways implementation. JFF envisioned these proof point regions as sites that have built Pathways systems with sufficient depth to serve as models for other Network member regions. Eventually, these regions might serve as “clinical” or “demonstration” sites where other regions in the Network could seek advice from peers and support in the early stages of implementation. Proof point sites are demonstrating progress on at least three of the four regional Pathways to Prosperity implementation levers:

1. **9-14 career pathways** with clear structures, timelines, costs, and requirements linking and integrating high school and community college curricula and aligning both with labor market needs;

2. An early and sustained **career information and advising system** strong enough to help students and families make informed choices about education and career pathways;

3. **Employer engagement** that leads to learning opportunities at the workplace and support for the transition of young people into the labor market; and
4. Local or regional intermediary organizations to provide the infrastructure and support for the development of such pathways.

The work of developing proof points is especially important because, while the Network is designed to show a positive impact on high school completion, degree or certificate attainment, and even labor market outcomes, such data is, unfortunately, a long way off. However, JFF and other organizations researched cohorts of early college students for a sufficient number of years for Pathways to take that impressive evidence base as an indication of what strong 9-14 pathways can accomplish with regard to student outcomes. Early college high schools, in which students are dually enrolled in courses for which they earn both secondary and postsecondary credit, have graduation rates that exceed national averages, and about one in three early college students earns an associate’s degree or other postsecondary credential before graduating from high school. Dual enrollment is associated with increased college GPAs and improved six-year college graduation rates. Research shows that low-income and first-generation college students are especially likely to benefit from dual enrollment and early college 9-14 models.

Demonstrating outcomes for the Pathways to Prosperity Network will be a challenge and require patience. Most 9-14 pathways begin with small cohorts of ninth graders, then add students and grade levels in each successive year, so initial cohorts are limited in size. In addition, determining which outcomes can be correlated with Pathways implementation will require a sophisticated evaluator, resources for comprehensive data collection, and student cohorts large enough to generate statistically significant results. However, the three proof point regions all have data collection procedures in place and substantial numbers of high school students in pathways thanks to their prior work establishing career pathways that Pathways to Prosperity enhances and strengthens.

THE PROBLEM: MARLBOROUGH

On May 23, 2015, Dan Riley, the director of STEM for the Marlborough, MA public schools, and Sylvia Beville, executive director of Partnerships for a Skilled Workforce (PSW) and her team were thinking long and hard about the agenda for the last meeting of the school year with their leadership committee. The leadership committee was made up of employers who had been deeply involved in the high school—participating in science fairs, hosting student visits at their companies, running teacher workshops on design thinking. But now Dan Riley and Sylvia Beville planned to ask their employer partners to do even more: to produce 100 paid internships over the next year.

FIGURE 1. LEVER-EMPLOYER ENGAGEMENT
What would they say? Dedicated though the school’s industry partners were they were to Marlborough’s STEM early college program, this was a big ask.

Finding the paid internships that they needed would require the Marlborough team to refine their strategies related to one of the key Pathways implementation levers: employer engagement. Marlborough had already made considerable progress in integrating work-based learning into their Pathways model. The region has integrated work-related exercises and applications throughout the curriculum, and a menu of visits and activities with employers and professional development programs introduce teachers to business processes. However, increasing the number of paid internships available to students remained a challenge. A closely linked need was increasing employers’ capacity to design workplace position descriptions suitable to both the needs of specific companies or sectors and to the skills and capacities of high school students.

BACKGROUND

Marlborough has already made substantial progress on key components of the 9-14 pathways and career advising and information systems implementation levers. Students identify a pathway at the beginning of their junior year of high school, and each pathway is aligned with a specific industry sector. The school has memoranda of agreement with two public higher education institutions, providing students with an opportunity to accumulate 18 college credits at high school graduation. During the 2015-16 school year, Marlborough is piloting pathways in engineering, computer science, information technology, and biotechnology. PSW carries out intermediary functions and helps create a regional career pathways system that integrates work-based learning.

In fall 2011, with funding from a Massachusetts Department of Elementary and Secondary Education Race to the Top grant and technical assistance from Jobs for the Future, Marlborough launched a STEM early college high school. Beginning in 2014, additional funding from a Department of Labor Youth CareerConnect (YCC) grant provided additional funding to build upon this work. JFF and partners, including Marlborough Public Schools and PSW, applied for the YCC grant using the Pathways framework as the guiding rubric and were awarded $4.9 million to scale up innovative high school models geared to regional labor-market needs over 5 years. In Massachusetts, the Pathways work is carried out under the College and Career Ready unit of the Massachusetts Department of Elementary and Secondary Education, and one feature that distinguishes the Massachusetts Pathways model from those of many other states and regions in the Network is that community colleges and WIBs—not school districts alone—serve as the organizing hubs for the work.

The Marlborough STEM program immerses 600 young people, grades 6 through 12, in advanced, interdisciplinary collaborative projects and work-based learning (WBL) at Marlborough Public Schools’ Whitcomb Middle School and MPS STEM Early College High School (M-STEM). M-STEM employs a non-tracking, non-leveling approach that begins in sixth grade, continues into secondary education, and is entirely honors-based. Students receive instructional supports as they progress through the problem-based advanced curriculum. Both vertical and horizontal teaming, in the form of professional learning communities, are common in both the middle school and high school. The scope and quality of

The Marlborough team has a challenge. YCC requires that 100 students have internships next year. What should they do to make this happen?

Ayora Berry: The traditional approach, internships, would be hard for us—we only hire BAs and although we have a rich history of internships, there’s not much a high school student could do, and we’d have to pay them. PTC is not in shape to do that now, and as a pipeline investment—which we need—we’d have to wait too long for them to be done with college. But we could do what Olin College does: Students are given a challenge a company faces, they go through an invention process with virtual and face to face mentoring. They present their results to the company. It’s much less costly especially if the school partner handles logistics.
project-based learning (PBL) has increased over time; currently, middle school students complete one project per semester and high school students complete four projects per year. The program is not targeted to the highest performing students. Rather, it serves average students who might not have postsecondary aspirations, English language learners (14 percent), Latino students (35 percent) and students with disabilities. Nearly half of the participants are eligible for free or reduced-cost lunch.

Fifty percent of eleventh grade students elected to enroll in M-STEM’s Pilot Pathways model for the 2015-16 school year. M-STEM has identified 16 different pathways matched to four major Pilot Pathway Clusters (Engineering, Computer Science, Biotechnology, and Information Technology). These pathways are coupled with individualized learning/development plans (IDPs). Naviance Family Connection will be used beginning in fall 2015 with all students starting their freshman year as a college/career-planning tool that houses the IDP.

Starting in tenth grade, students earn college credits through partnerships with Quinsigamond Community College (QCC) and Framingham State University, a four-year public institution. M-STEM has MOUs with these colleges for dual enrollment courses that include expository writing (12 students), college writing (12 students), Intro to C++ (9 students) and Intro to Web Design (2 students). Because M-STEM is located about 25 miles from the colleges, the partners employ a hybrid course delivery model; students participate in college coursework on site at MHS, take courses online, and participate in college visits to experience the campus environment.

M-STEM has also established a blended model for Advanced Placement classes that includes articulated courses for skills areas (CAD for college credit), as well as online college courses. This allows students to have at least a semester’s worth of postsecondary study prior to high school graduation.

THE EMPLOYER ENGAGEMENT CHALLENGE: BEYOND SCHOOL-BASED LEARNING

IN-SCHOOL CAREER PREPARATION

As Marlborough works toward the goal of ensuring that all rising seniors participate in work-based experiences in companies, M-STEM students are participate in an extensive range of school-based career preparation activities. Not only is the curriculum sequenced in such a way that in sixth through tenth grades students gain the foundational skills and knowledge required for advanced work in eleventh and twelfth grades, but industry perspective and participation is woven into students’ daily activities at school. More than a dozen industry partners are making important contributions to in-school activities.
COMPANY REPRESENTATIVES: A SAMPLE

**PTC.** Ayora Berry, an experienced education manager, instructional designer, and teacher trainer, works in the K-12 education division of PTC, Inc. The company’s goal is to foster innovation in product development and the Internet of Things through software and service partnerships with 27,000+ manufacturing companies across the globe. Berry’s contributions to and activities with Marlborough’s school community include supporting the district’s PBL and STEM/STEAM education strategy, supporting teachers’ curriculum innovation, providing students with industry design challenges and mentoring, and connecting the school with PTC’s worldwide education and industry community. PTC has a 6 to 8 person K-12 education team, as well as a postsecondary team of 25.

**Dow.** Research Scientist Phillip Hustad is an award-winning chemist in the R&D unit of Dow’s Core R&D division, where he is responsible for development of advanced block copolymer systems for electronic applications and invention and development of advanced polymeric materials for lithographic patterning. Associate Research Scientist Paul LeBeaume has a background in bioorganic and medicinal chemistry. Dow is deeply involved in education under the banner of STEMtheGAP™, a series of initiatives to support and advance STEM education, including a teacher challenge, robotics competitions, and curriculum dissemination. Dow’s role in Marlborough is unique. Phil and Paul have organized colleagues to judge science fairs and to install a booth and judge the STEM EXPO. This year, they piloted a half-day field trip to the company and hope in the future to provide a similar experience to 50 percent of ninth graders. The carefully planned event was structured around the invention, scale up, and quality control processes in the company. Dow first brought in teachers, and then hosted six students selected by the school. Each student prepared a slide about him or herself and why he or she wanted to be there. Working in groups, they delved into the company’s processes. The company also hosted two weeklong internships for Marlborough students, one of which resulted in research that the company is using.

**Boston Scientific.** The company, one of the world’s largest medical device makers, invites Marlborough’s eighth grade STEM cohort to participate in a day of work-based learning at the company. More than just a “walk around,” structured on-site activities teach students about topics such as why statistics are important and how to learn from mistakes. The company has also provided resources at critical junctures, such as printing 30 students’ large-scale models on their 3D printers for the STEM EXPO.

**Marlborough Hospital.** The hospital hosted a team of interns who developed a plan for the orthopedic service line to raise awareness about sports injury prevention. The interns then went one step further and developed a class for their peers at Marlborough High School to help prevent sports injuries.

**Raytheon.** Jim McGrath retired as an Engineering Fellow at Raytheon Network Centric Systems. With a long history of work with area schools, Jim and a Raytheon team created project-based learning opportunities in Marlborough classrooms. One project involved Raytheon engineers helping students create an energy-efficient roofing system to store water. LEED certified engineers reviewed student designs. However, high school internships are not usual at Raytheon—for security reasons, among others.

How did you get involved in the Pathways work?

**Paul LeBeaume:** I wanted to give back, and thought about it a long time, until I had a light bulb moment. I’m a chemist, so why not give back with chemistry. Then I realized there was a growing interest across the company in STEM for the community. I reached out to the MSTEM team and said, we’ve got people who want to volunteer. How can we help? We met and created an exciting vision together. I brought it up to the president and VP level and got 110% support. But scaling paid internships is not going to be easy. Even taking in two students, I talked to a lot of people who said, “this is impossible.” And it took a lot of effort to find projects valuable to Dow and right for a high school student, but once a young person is up to speed, perhaps they could come for a month or six weeks.
M-STEM has a three-tiered approach that allows industry partners to engage in a variety of activities that range from career awareness to training, including STEM fairs, career panels, roundtables, and project-based learning, as well as a limited number of internships. STEM Office Interns are a particularly interesting feature of the in-school work. Working for the high school, students organized technology user agreements, created FAQs, repaired broken Chromebook screens, took inventory of classroom projectors, and set up study guides and project resources for students new to STEM. In FY16, M-STEM plans to expand in-school internships throughout the high school.

In addition, students are using robotics technology, 3D printers, and CAD programming. Plans are in place to train students in computer numerical control, mostly in woodworking, as well as simulation software geared toward milling. PTC, a global company that produces technology-enabled solutions to help manufacturers transform the way they create, operate, and service products, provides particularly generative school-based activity. STEM expert Ayora Berry, a senior program manager in PTC’s Global Education Program, works with teachers and students and helps teachers gain familiarity with and experience in design thinking that results in product development curriculum. Below is a snapshot of the PTC-sponsored Product Development Work Day at the high school.

NETWORK LEADERSHIP TEAM
A network leadership team comprised of one representative from each of the companies that works with the high school leads the development of M-STEM’s critically important partnerships with employers. The group, chaired by PSW Executive Director Sylvia Beville, includes representatives from 10 companies, among them senior scientists from Dow Chemical and the research and development director of Boston Scientific, as well as two health care executives, the mayor of Marlborough, and three members of PSW’s staff: the Youth Director and the YCC-funded STEM career specialist are members along with PSW’s Executive Director. Attendance of this group is consistent and regular. The group has met quarterly over the last nine 9 months; it may meet semi-annually moving forward. In each meeting, the leadership team plans the implementation of specific
metrics in the employer engagement Pathways lever. Below is the leadership teamwork plan for work-based learning developed by the group.

INTERNSHIPS

The leadership teamwork plan outlines Marlborough’s anticipated activities and timeline for establishing an internship curriculum and experiences for students, work-based learning outcomes, and data collection procedures to track and measure progress across WBL activities. The site is continuing to develop a comprehensive and tiered WBL structure and to expand industry partnerships. They have a designated staff person primarily responsible for securing additional employer partnerships. The completion of a data plan that includes student-level metrics will provide a guidepost for continuous improvement and accountability.

In summer 2015, 10 students completed internships, three of them paid, across a variety of companies: Marlborough Hospital (6), Dow Chemical (2), Hologic (1), and the Engineering Pipeline Program at National Grid (1). Because Marlborough is operating within the YCC guidelines, companies were required to provide a total of 25-40 hours of work during the summer.

THE BIG ASK: SCALABILITY OF INTERNSHIPS

As the steering committee gathered at Boston Scientific on May 23rd, Sylvia Beville introduced the agenda, the small group work assignments, and the goal. After the group engaged in a facilitated discussion of their vision and goals, they would come up with the parameters for a quality internship. The puzzle confronting the team was how to design an internship that would make sense across very different

LEADERSHIP TEAMWORK PLAN

1. Continue to develop and support comprehensive WBL structure for fall Institute presentation.
   a. Complete Action Plan with specific, measurable, and detailed deliverables and timelines
   b. Develop a model to further integrate employers in WBL (e.g., co-designing curriculum and co-teaching)
   c. Establish early connections in middle school for WBL (Possible Futures, Possible Selves)
   d. Build and extend mentorships
   e. Continue to build teacher externships
      i. Framework, model, protocols for teacher/employer visits
2. Support the identification of metrics and methods for data analysis.
   a. Accountability measures that determine student learning outcomes (including social/emotional, non-cognitive factors)
   b. Facilitate peer collaboration with other proof points sites/members of the Network
3. Assist with the development of Marlborough’s presentation for the Fall Institute.
   a. Provide guidance and feedback around focus, content, and delivery
   b. Help identify and polish any artifacts that may be of interest to other members of the Network
companies. For example, Raytheon had work with data analysis and modeling, while Marlborough Hospital had an entirely different set of needs.

During a visit to High Tech High in San Diego, the team had observed that every junior completed an internship, which gave them an edge as college applicants. The team wanted to provide Marlborough students with that advantage, but wasn’t sure how to accomplish this for all 100 rising seniors. Finally, they worried about sustainability. Because of the team’s passion and strong leadership and organizational skills, they had a committed set of company representatives, but could they build the kind of sustainable internships that would be available year after year—even through personnel changes in the company?

The crowd broke into designated groups, each led by a facilitator. Their assignment was to create a student intern job description that included:

- Unique requirements of company, if any
- Integration into the work of the company
- Hours per week and number of weeks
- Number of interns
- Paid or unpaid

The group discussed the types of internships they were already offering and how they could adapt those for high school students. Most of the companies said their interns were primarily grad students working on degrees in biotech, big data, or biochemistry. Other insightful questions arose: Do you recruit interns for their leadership qualities as well as for their content knowledge? Could the grad student interns take responsibility for high school interns? How would M-STEM get from this summer to 100 internships for next summer?

The team reached a consensus about the need to emphasize quality over quantity, and Dow and Marlborough Hospital volunteered to pilot internship programs for the summer of 2015, while the rest made promises for the following year. The meeting’s outcome was positive: industry partners in Marlborough seriously considered the challenge of scaling up internships and took steps to address it. However, work remains to be done if Marlborough is to achieve its goal of 100 internships:

- What are the best practices for matching students with varied needs and levels of preparation with internships in companies with varied needs? What supports will be needed to make these internships a success for all partners?

### TABLE 1. CONSENSUS FROM THE LEADERSHIP ON WORK-BASED LEARNING

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<tr>
<th>HOW COMPANIES CAN SUPPORT LEARNING:</th>
<th>HOW STUDENTS CAN ADD VALUE</th>
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<tbody>
<tr>
<td>Meet and become familiar with students at STEM events.</td>
<td>Research company and understand what they do.</td>
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<tr>
<td>Orient students to the workplace and introduce them to co-workers.</td>
<td>Be honest and dependable. Arrive on time and appropriately dressed.</td>
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<tr>
<td>Review the WBL plan in writing with the student and walk through a typical schedule and possible scenarios.</td>
<td>Review the WBL plan together. Ask questions. Take notes. Use the plan as a guide.</td>
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<tr>
<td>Model the skills, habits, and knowledge you want to develop.</td>
<td>Follow directions carefully. Concentrate on the work at hand.</td>
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<tr>
<td>Allow students chances to overcome obstacles and model how to learn from failure.</td>
<td>Read, write, and calculate well.</td>
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<tr>
<td>Offer opportunities to practice communication skills through presentations, teamwork, and reports.</td>
<td>Recognize problems and find creative solutions.</td>
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<tr>
<td>Determine how you would like the school coordinator to intervene if problems arise.</td>
<td>Manage time. Finish jobs without sacrificing quality.</td>
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What strategies should partners in Marlborough pursue as they seek to scale up internships? What would it take to position PSW to leverage opportunities created by students who seek out internships independently or with support from their personal and family networks?