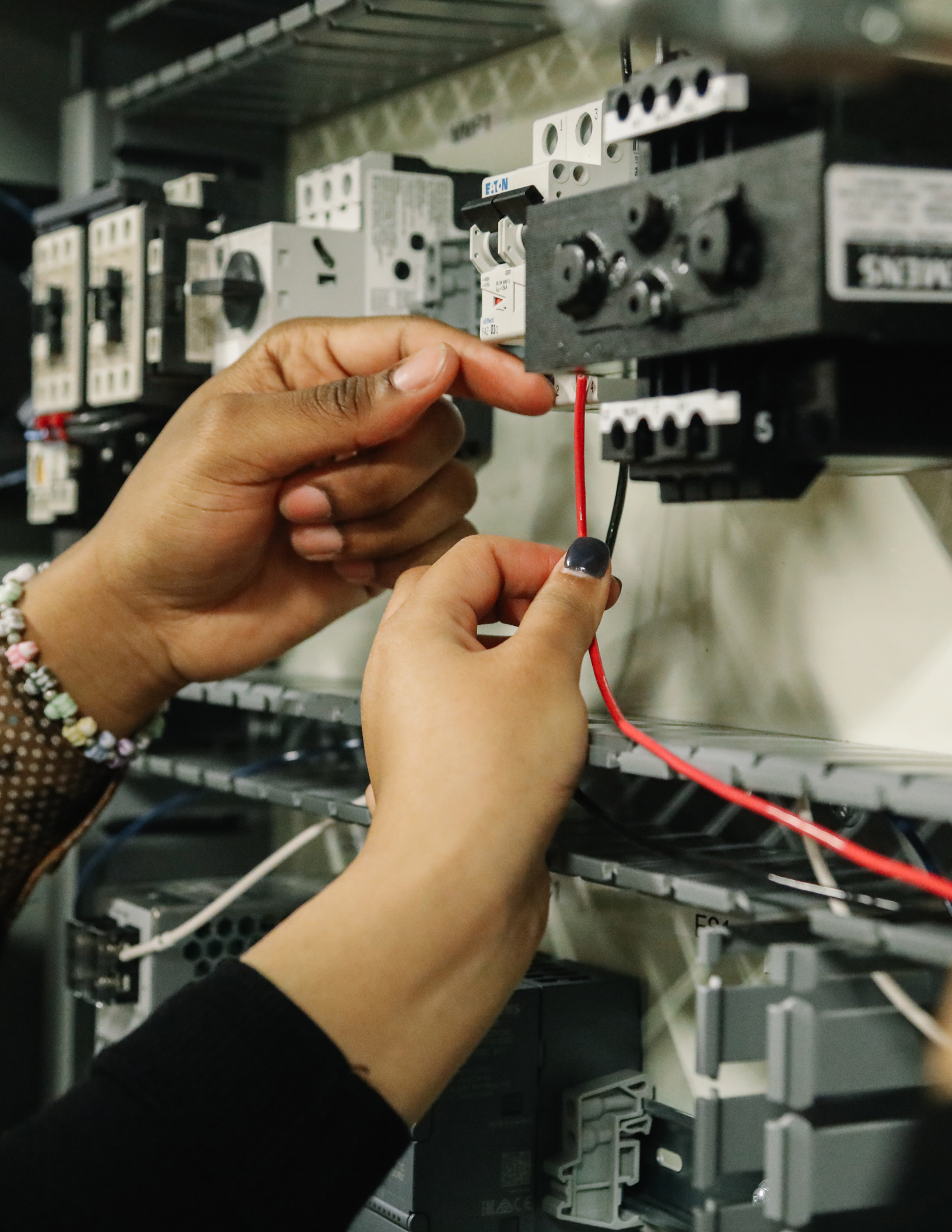




## BEST PRACTICES FOR EQUITY IN ADVANCED MANUFACTURING EDUCATION: A CASE STUDY OF THREE AMT PROGRAMS

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## EXECUTIVE SUMMARY

Over the next decade, the United States will need to fill nearly 3.5 million manufacturing jobs, but 2 million jobs may go unfilled because not enough people are trained to do them.<sup>1</sup>

We will miss the opportunity to fill these in-demand jobs if we do not find better ways to attract women and people of color to manufacturing. Data for 2022 underscore the need for more targeted recruiting.

- 10.8 percent of the manufacturing workforce is Black or African American.
- 17.4 percent of the manufacturing workforce is Hispanic or Latino.
- 29.3 percent of the manufacturing workforce is women.<sup>2</sup>

Inclusion of women and underrepresented populations is a timely and necessary strategy to solve the skills gap in manufacturing. This type of demographic shift requires a new perspective to guide recruitment and retention efforts. The Toyota USA Foundation awarded funding to the [National Alliance for Partnerships in Equity Education Foundation](#) (NAPEEF) to create promotional tools and outreach strategies for educators and career recruiters to use with students and parents at the K-12 and community college levels.

A research team from NAPEEF, as a part of the [Make the Future™ Initiative](#) (MTF), reviewed the research literature and identified nine best practices to increase the participation and retention of women— particularly Black, Indigenous, or Native women— and people of color, in science, technology, engineering, and mathematics (STEM)-related programs of study

and Career and Technical Education (CTE), leading to careers in advanced manufacturing. This work is meant to guide Advanced Manufacturing Technician (AMT) and other advanced manufacturing program recruiters, instructors, and plant personnel to achieve the following goals:

- Increase the interest of women enrolled in secondary schools in advanced manufacturing by 25% in targeted communities.
- Increase the participation of women in advanced manufacturing programs of study by 25%.
- Increase the participation of women in advanced manufacturing postsecondary programs by 25% in targeted communities.
- Develop further MTF resources for use in professional development.
- Increase the number of educators accessing the MTF resources by 100%.

NAPEEF conducted initial case studies at two AMT sites (San Antonio, Texas, and Vincennes, Indiana) in 2022 to validate the nine best practices and to understand their influence on mindsets and outcomes in recruitment and participation in their AMT programs. Because of the COVID pandemic and its impact on educational recruiting and programming, NAPEEF expanded on the early work by revisiting the two sites and adding a third site in Jackson, Tennessee, to explore efforts post-pandemic. The original case studies were conducted virtually, which impacted the depth of understanding and the participation in the case studies. The new case studies described in this report were conducted during 2-day, onsite visits, during which the research team interviewed students, program personnel, and plant supervisors, and administered a student survey to all AMT students.

This case study report describes the relationships between manufacturers and the sites' AMT programs, as well as the experiences of students who are participating or graduated from these programs. In addition, drawing on both qualitative and quantitative evidence, the report highlights lessons learned and validates the shifting mindsets and perspectives that result from intentional and strategic use of the nine best practices to recruit women and underrepresented populations into programs of study that lead to manufacturing careers.

Further, these case studies provided content for four mini-courses that NAPEEF developed for use by recruiters and manufacturers to increase participation of women and underrepresented populations in the field. These courses will be made available nationally and will validate the nine best practices, showcase how the MTF programs have used these best practices in different contexts, and offer tools to help other programs audit their current messaging and recruitment practices.

The nine best practices are divided into three key steps in the recruitment process. The first step focuses on inspiring women to explore opportunities in manufacturing:

- Reach out to middle and elementary school students
- Use targeted and personal invitations
- Design single-gender, small-group activities
- Once women are inspired, programs can move to the next step, which focuses on exploration.
- Use same-gender, same-race role models
- Provide repeated exposure to manufacturing careers
- Design interactive hands-on activities

The final step focuses on expanding the

influencing network of people who encourage women to participate in manufacturing programs and careers.

- Connect with parents/caregivers
- Partner with community organizations
- Create work-based learning opportunities

The case studies highlight the following: how the three sites are employing the strategies; how they impact recruitment, support and the overall program experience and success for women in their programs; and how they can identify and address missed opportunities and recommendations.

## METHODOLOGY

The research team employed a mixed method approach that collected data through student surveys with current AMT students and interviews with women who graduated or are currently enrolled in the AMT program, program coordinators at the partnering universities, and plant supervisors and HR professionals from the partner manufacturers. The team sought answers to the following research questions:

1. What people or messaging influenced women to explore careers in manufacturing?
2. How are the recruiting practices at the sites aligned to the nine best practices?
3. What do the women experience in the AMT program classroom and on the job site?
4. How has the increase in participation by women changed perceptions, added value to the classroom and workplace teams, and changed the culture within the program?
5. What gaps and barriers still exist, and how are the programs actively working to address them?

## QUANTITATIVE DATA

AMT instructors provided a link to our survey to all AMT students and administered the survey during their class period. The survey asked students to respond to questions related to their pathways into manufacturing, their experience within the classroom and on the job site, and their perceptions of how well they were supported and included to pursue their careers in manufacturing.

The table below shows the breakdown of 94 students who responded per site.

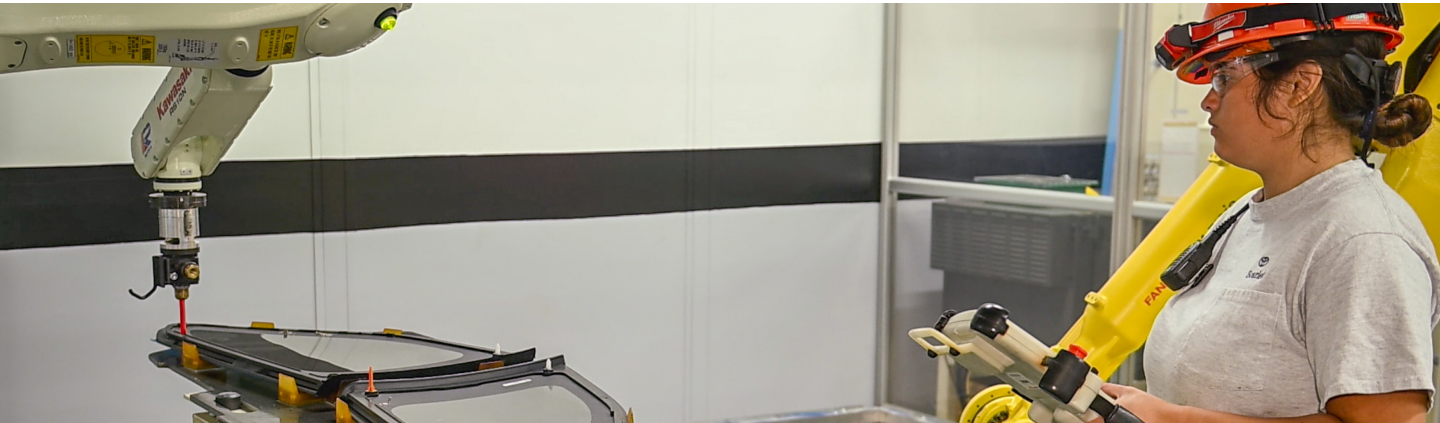
	Indiana	Texas	Tennessee
<b>Total Respondents</b>	25	23	46
<b>Women</b>	4	4	1
<b>Men</b>	20	19	45
<b>Prefer not to report gender</b>	1	1	0
<b>White</b>	24	14	29
<b>Asian</b>	0	2	0
<b>African American or Black</b>	0	3	4
<b>Two or more races</b>	0	3	7
<b>Native Hawaiian or Other Pacific Islander</b>	0	0	1
<b>Prefer not to report race</b>	1	0	5
<b>Hispanic</b>	0	0	0

## QUALITATIVE DATA

The research team conducted 16 onsite interviews with current and former women students in the AMT program and 1 interview with a student who selected “prefer not to say” on their survey. In Texas, all students were first- or second-year AMT students. In Indiana, all but one students were current students. In Tennessee, two of the students were former students and four were current students. The team also interviewed program personnel and/or instructors at each site, and, in Tennessee, we interviewed plant supervisors at four different manufacturers who participate in the AMT program co-op.

The table below summarizes the types of participants by site.

Site	Role
<b>Indiana</b>	1 AMT instructor, 1 AMT program manager from the university
<b>Texas</b>	1 AMT instructor, 1 Toyota AMT program manager
<b>Tennessee</b>	2 instructors, 4 plant managers, 1 AMT program manager from the university
<b>Total</b>	11



The table below shows the breakdown of the students and program personnel interviewed and the interview locations, by site.

Site	Number of student interviews	Number of program personnel interviews	Number of plant supervisors	Locations of interviews
Vincennes	5	2	0	Vincennes University AMT classroom and Toyota Manufacturing Plant in Princeton, IN
San Antonio	6	2	0	San Antonio AMT classroom at Alamo State College and Toyota Manufacturing Plant in San Antonio, TX
Jackson	6	3	4	Jackson State Community College, Blue Scope Manufacturing, ASSA ABLOY, Ceco Door Manufacturing, Pacific Manufacturing, and Toyota Motor Manufacturing Tennessee

The interviews were semi-structured and videotaped. The research team watched the student interview multiple times to identify themes and codes categories related to participant recruitment experiences, programmatic experiences, support, and influencers (both people and messaging) that led them to their career pathway. The team coded interviews of instructors and site supervisors related to perceptions of the value of women in manufacturing, deployment of the nine best practices within (inspire, explore, and expand), and barriers to participation or retention of women participants.

## PROFILES OF CASE STUDY SITES

The three sites for this case study were selected because they have made a significant effort and commitment to equity and/or have been deemed successful and focused on attracting and retaining women to their AMT programs. The sites are associated with or accredited by the [Federation for Advanced Manufacturing](#)

[Education](#) (FAME), the premier advanced manufacturing workforce education and development program. Students enrolled into the FAME Program engage in a work/study program to earn an associate's degree and certification as an advanced manufacturing technician. FAME students attend classes at a local community college 2 days a week (8 hours or more each day) and work at least 24 hours a week (8 hours or more each day for 3 days) for a local, sponsoring employer. Students are paid for working at the plant during the program, so they earn while they learn. Program staff and manufacturing partners work closely together to recruit and support AMT students. Program staff regularly visit the plants, where students collaborate with the plant supervisors. The program coordinator leads the recruitment, program design, and partnerships for the FAME program. In Texas and Indiana, the program coordinator is a Toyota employee who works closely with the dean or lead instructor at the college. In Tennessee, the program coordinator is a leader at the college who works collaboratively with all of the manufacturing partners.

## TEXAS FEDERATION OF ADVANCED MANUFACTURING EDUCATION, SAN ANTONIO, TEXAS

The AMT program is a partnership between [Alamo College District](#), [St. Philip's College](#) location campuses, and [Texas Federation of Advanced Manufacturing Education](#) (TX FAME) manufacturers (Toyota, Kautex, HEB, CH Guenther and Sons, CAT, Metalsa, Toyotetsu, CPS Energy, and Joyson Safety Systems). The program coordinator for TX FAME has been engaged with the program for 10 years.

## SOUTHERN INDIANA FEDERATION OF ADVANCED MANUFACTURING EDUCATION, VINCENNES, INDIANA

The AMT program is a partnership between [Vincennes University](#), area manufacturers (AmeriQual, Berry Global, The Hershey Company, Toyota, Toyota Boshoku Indiana, Toyota Boshoku Illinois, and Thyssenkrupp Presta), and the [Southern Indiana FAME](#) (So. INFAME) chapter. The program coordinator for So.INFAME has been engaged with the program for 10 years.

## TENNESSEE FEDERATION OF ADVANCED MANUFACTURING EDUCATION, JACKSON, TENNESSEE

The AMT program is a partnership between [Jackson State Community College](#), 28 area manufacturers, and the [TN FAME chapter](#). The program coordinator for TN FAME has been engaged with the program for 10 years.

## FINDINGS

The three sites for the case studies represent different regions and cultures within the United States. The Indiana site is located in a rural, Midwest area, and the students in the program are not racially diverse. The Texas site is located in a rural area near San Antonio—an urban area that is home for most of the students in the program and that offers more opportunities to develop educational pathways. The Tennessee site is located in a very rural area that ascribes to southern U.S. cultural norms. The program manager indicated that the women in the program face barriers related to how southern women are taught to behave and their roles in society. Although this stereotype is changing, the women interviewed reported many more gender-based barriers than did the women from Texas or Indiana. The two rural sites serve





schools that serve very few students. Urbanicity is evident throughout the case studies and informs some of the differences between the programs' recruiting practices.

## RESEARCH QUESTION 1

### *What people or messaging influenced women to explore careers in manufacturing?*

When present, recruiting programming had a positive influence on the women's decision to enroll in the AMT program, especially when the program pathways start in middle school. Texas FAME's comprehensive recruitment strategy stacks programs that start in middle school STEM programs and continue through dual credit high school programs and other STEM and CTE programs to the AMT program. [Alamo Academies](#) is a partner that offers internships and dual credit STEM programs. It is housed in the same building as the AMT program, which enhances the ability to recruit students to the AMT program.

This targeted and pipelined strategy appears to be working and underscores the value of starting early, partnering with schools, and providing repeated opportunities for exploration. The area schools offer stacked programming from middle school through the AMT program, and four of the six women in the program participated in at least one of these programs before applying to TX FAME. One student attended a STEM middle school, engaged on a robotics team, participated in dual enrollment at a STEM high school, participated in the Alamo Academy, and then applied for the AMT program. Another student attended a STEM high school, attended a

summer internship at Toyota, between her junior and senior years and then attended Alamo Academy.

For the two students who did not participate in the stacked programming, one was influenced by her boyfriend, who graduated from the TX FAME program and encouraged her to try it. The other student was influenced by a woman AMT at Toyota. While working for a supplier at the plant, she was shocked to see a woman wearing an orange hard hat, which denotes skilled worker. After talking with that woman about her role with Toyota, she decided to enroll in the AMT program and follow the same path. This influence underscores the power of seeing same role models of the same gender and race as a high-powered strategy for recruitment.

In Tennessee and Indiana, recruiting generally includes annual visits to local high schools on career days, and this strategy influenced two women to enroll. Two of the women in Indiana learned of the AMT program through these visits during their junior or senior year of high school and heard a presentation by an AMT recruiter. Staffing shortages and turnover plague the Indiana program, which makes participation in career fairs at local schools difficult. Only one student in Tennessee remembered a career fair at her high school, but she had planned to pursue a career in health care, so did not pay attention to the advanced manufacturing recruitment. The program director at Jackson State Community College remarked that face-to-face recruiting is challenging because the college is located in a very rural area with approximately 30 schools—some with graduating classes of fewer than 100 students. In both Indiana and Tennessee, recruiting relies on an invitation by local schools to present the AMT program at career fairs.

Program staff at both sites prefer to take AMT students with them, especially women, but removing them from class for school visits is complicated.

Most of the women we interviewed in Indiana and Tennessee did not benefit from a formal recruiting program or participate in formal recruiting events, so they were not influenced by program staff or strategic recruiting messages designed by the AMT programs or partner manufacturers. Further, few CTE high school programs related to advanced manufacturing exist in Tennessee, and most CTE programs in Indiana are geared toward agriculture and not advanced manufacturing. Several of the AMT students in Tennessee reported a lack of CTE coursework or STEM programs. Most of the schools they attended had industrial arts programs, but three of the women reported they were denied the ability to take industrial arts as an elective because they are women.

Because of the limited STEM programming and recruiting efforts, most of the students in Tennessee and Indiana were influenced by family, friends, or guidance counselors. Two of the students met the program director at Jackson State Community College by chance while they were enrolling in general studies, and she convinced them to enroll in the AMT program. Three of the women in Tennessee and one of the women in Indiana were nontraditional students who were already working in manufacturing or the trades and then entered the AMT program for advancement and higher pay. One interviewee in Indiana was working in HVAC (heating, ventilation, and air conditioning) after high school and was introduced to the AMT program through a friend. The career paths of two students in Tennessee were diverted

because they had children and ended up on the production line in manufacturing. They learned of the AMT program through other AMT students or friends, joined the program as a way to upskill, and earn more income to support their families.

Almost half of the women across the three sites enrolled after graduation and learned about the program by chance. Most women had more than one influencer, which underscores the need for repeated exposure to manufacturing. In addition, many of the women cited that early experiences with hands-on maintenance (e.g., helping their fathers at home) were significant influencers, which underscores the value of starting early and providing hands-on experiences as powerful recruitment strategies. The women reported the following influencers during high school:

- Participated in the STEM manufacturing pathway during high school.
- Encouraged by stepfather to consider STEM as a good career pathway and then participated in a high school STEM program
- Participated in an Upward Bound College Access program and visited the campus
- Attended a presentation by a representative from the AMT program during her senior year. She always enjoyed helping her dad with hands-on work, such as electrical work.
- Encouraged by her father, who works at Toyota, to enter the AMT program. She participated in CTE electrical classes in high school after working on the lighting crew for a drama club
- As a child, assisted her father, who works at Toyota, with car and lawn equipment maintenance
- Worked on cars at her father's automotive shop and developed an interest in maintenance at a young age. She learned of the AMT program at a career fair her

sophomore year and first enrolled in a high school AMT program first.

- Recommended to the AMT program by a counselor whose son was a participant
- Recognized the potential to earn a living and liked working with her hands, so she was recruited into the program at a career fair



The women reported the following influencers after high school:

- One woman worked for one of Toyota's suppliers and was influenced by seeing a woman in the maintenance field at the plant.
- One woman worked in HVAC after high school and learned of the AMT program from a friend and alumni of the program.
- One woman was influenced by her boyfriend who participated in the AMT program after high school.
- Two women learned of the AMT program at a plant where they worked in production. One referred the other to the program while she was at the plant for the AMT program.
- One woman planned to pursue a career in medicine but became pregnant and could not do the schooling. While working after high school, she learned of the AMT program through a friend. She was attracted to the hands-on aspect of the job and the potential to earn enough money to care for her child as a single parent.
- At the age of 8 years, one woman gained an interest in the electrical trade and the ability to do basic electrical work through her grandfather. However, she was not funneled

into a CTE program or the AMT program. She was enrolling in another program at the college when the AMT program manager overheard her story and recruited her on the spot.

In Indiana and Tennessee, none of the interviewees experienced early recruitment for the AMT program. Although one of the nine best practices is to start programming in elementary or middle school, early programming does not appear to occur at these sites. Currently, both sites reported that they host annual events, such as a robotics competition, but whether these programs existed for the current AMT students when they were in middle school remains unclear.

Most of the women did not consider a career in advanced manufacturing as children. One was interested in the medical field, one dreamed of being a forensic anthropologist, one explored archaeology, and several planned to be veterinarians, teachers, or nurses. Three of the women knew from an early age that they wanted to be involved with a STEM career related to automotive, scientific research, or electrical trades. One woman was solely focused on finding a career that would enable her to be financially independent and comfortable. Nearly half of the women were influenced through friends or family who work in manufacturing or the trades and introduced them to opportunities as AMTs.

All of the interviewees indicated that their gender did not impact their decision to pursue a career in manufacturing. However, several acknowledged that they viewed manufacturing as a male-dominated field and would need to work hard to fit in. Two of the women reported the need to convince their families that they could succeed in this type of career.

A best practice is to engage role models of the same gender and race in recruiting, but no such programming appears to be in place. The program personnel indicated they make an effort to bring the women in the AMT program to recruiting events as role models, so future AMT students have access to women role models that may influence them to enroll. However, most of the women did not identify a role model during recruiting events who was a woman. One student was influenced to participate in the program due to seeing a woman at Toyota in a skilled position while she was working at the plant as part of her job with a supplier, but this experience happened by chance and was not part of the recruiting strategy. She told a story of being at the plant and seeing a woman in an orange hard hat. Orange denotes a skilled worker, and she was surprised to see a woman in an orange hard hat. She asked the woman about what she did at the Toyota plant and was inspired to follow in her footsteps. She quit her job and joined the AMT program. Increasing the visibility of women in skilled positions is an area of opportunity for recruiting at all locations to enhance their recruiting efforts.

Women are inspired by other women. Including same gender role models in a more strategic way is a missed opportunity. Two students were inspired by women who served as their instructors for their Texas Toyota summer internship program. One student was inspired by her mother, who worked in manufacturing. These responses are especially interesting because the past two presidents of the Indiana Toyota plant have been women. Because TX FAME has already graduated many women who are now working at Toyota, the current students are exposed to women role models. Toyota AMTs work in teams, and the students

are mentored by the team lead. Several of the women referred to TX FAME graduates who are women and are now team leaders and mentors as key support people who have helped them succeed in the program. Leveraging women in the field during recruiting events could be a useful strategy for inspiring more women to engage in the programming that leads to AMT enrollment and retention.

Several women expressed an interest in being role models for potential and current AMT students. All of the women said they would tell recruits that they can do anything if they work hard and that automation has reduced the physical requirements, leveled the playing field, and made the job accessible to women. In Tennessee, but not Texas or Indiana, the earliest graduates said they would warn students of the need to have a thick skin and work twice as hard as the men in the program. The earliest graduates in Tennessee shared stories of sexual harassment and hazing in the plants and work sweeping floors or taking notes rather than on the equipment as their male counterparts were doing. The more recent graduates and current students did not share this experience, so it appears that the culture is evolving and women are not facing the same types of gender-based barriers in that region. The plant supervisors and instructors unanimously welcomed women, recognized their strengths in problem solving, and noted that having diverse perspectives has strengthened their teams and improved the plant's culture.

The value propositions that resonated with the women were similar. All of the women noted that the hands-on aspect of the work attracted them to the program. More than half cited the pay as a major influencer, because they aspired to be financially independent and able to care

for their children and families. All mentioned that the ability to earn money while learning was a key factor in their decision to enroll. They also unanimously valued the ability to apply their learnings to their work in the plant in real time. All but one women valued the teamwork and collaboration aspects of the job, and noted that team members cared for each other, supported each other, and leveraged each other's strengths to be successful. The women also liked problem solving and the ability to use creative thinking to solve unique problems in their jobs. Three of the women spoke at length about their role in making things better, for example, safer.

These value propositions confirmed that women care about the 3 Cs: collaboration, caring and creativity. Research on career decision making by young women has indicated their attraction to jobs with the three Cs. However, their perceptions of the influence of the three Cs on their pursuit of advanced manufacturing required several prompts to think about their work through the lens of creativity, caring and collaborative. When asked a more open-ended question about what they valued, the pay and the ability to work with their hands were cited as the most important aspects of the job that influenced their decision to enroll.



### SURVEY RESULTS RELATED TO INFLUENCERS

The survey also included items to better understand the influencers of women in the program compared to those of men in the program. Specifically, we asked respondents to rank the level of influence of various factors and messages on their decision to enroll in the AMT program on a scale of 0 to 4 (0=not influential at all to 4=extremely influential). The influencers below are coded as following:

- Little to no influence (average below 1)—red
- Somewhat influential to influential (average between 1 and 1.9) —green
- Influential (average between 2 and 2.9) —blue
- Very to extremely influential (average 3 or above) —yellow

The table below shows the averages of the responses.

Influencer	Site	All	Women*	Men
A family member or friend is in a manufacturing career	ALL	1.5	0.9	1.6
	TX	1.7	.3	1.9
	IN	1.4	1.4	1.4
	TN	1.6	*	2.0
My friends were interested in joining with me	ALL	0.9	.6	0.9
	TX	1.0	.8	1.1
	IN	1.0	0.6	1.1
	TN	0.7	*	0.7
The recruiter got to know me and inspired me to participate	ALL	1.4	1.1	1.5
	TX	1.6	1.3	1.7
	IN	1.2	1.0	1.2
	TN	1.4	*	1.6
The recruitment events engaged me	ALL	1.4	1.4	1.4
	TX	1.4	1.3	1.5
	IN	1.4	1.4	1.4
	TN	1.3	*	1.4
I saw other people like me in the field	ALL	1.8	1	1.8
	TX	1.8	1	2
	IN	2.1	1.6	2.3
	TN	1.6	*	1.6

Influencer	Site	All	Women*	Men
Manufacturing jobs are well-respected, secure, and offer good wages	ALL	2.6	2.3	2.6
	TX	2.8	2.3	2.9
	IN	2.8	2.4	3.0
	TN	2.4	*	2.6
One of my teachers encouraged me to enroll	ALL	1.4	1.7	1.3
	TX	1.2	1	1.2
	IN	1.7	1.4	1.8
	TN	1.3	*	1.4
The job is very team-oriented	ALL	2.2	2.2	2.2
	TX	2.4	2	2.5
	IN	2.2	2.4	2.2
	TN	2.1	*	2.4
The pay is good	ALL	2.7	2.6	2.7
	TX	2.4	2.5	2.4
	IN	2.7	2.4	2.8
	TN	2.9	*	2.8
Manufacturing is a field that makes the world better for others	ALL	2.1	2.3	2.1
	TX	3.0	2.3	2.5
	IN	2.0	2.0	2.0
	TN	2.1	*	2.2
Job security	ALL	2.9	2.8	2.8
	TX	3.0	3.3	2.9
	IN	3.0	2.6	3.2
	TN	2.7	*	2.7
Manufacturing jobs allow me to be creative	ALL	2.3	2.5	2.3
	TX	2.8	2.8	2.8
	IN	2.2	1.8	2.3
	TN	2.2	*	2.5

\* Only one woman is currently enrolled in the Tennessee FAME program, so her results are omitted from the disaggregated results to protect her data from being personally identifiable. Her data are included in the aggregate. In addition, one survey respondent who chose not to identify a gender is included in the aggregate but not reported separately to protect their identity.

Analysis reveals these notable findings:

1. None of the selections trended toward extremely influential for all students. This finding indicates that a variety of influencers is needed for recruitment, because one influencer does not unanimously drive enrollment, and none of the influencers trended toward extremely influential for participants.
2. Job security was the highest rated influencer overall, but it still scored at the lowest end of the rating for influential (3). It did not appear to be a greater influencer for one gender over the other and was not an influencer for participants across all three sites.
3. The influencers related to recruitment events or people engaged in career planning (teachers and recruiters) had limited influence on students' decisions to pursue the AMT program. The messaging about the value of careers in manufacturing was more influential than the events or people. This finding could be due to the lack of recruiting opportunities at two of the sites.
4. The variability in responses between men versus women was insignificant except for two influencers (more than 0.5 point difference): "A family member or friend is in a manufacturing career" and "I saw other people like me in the field." This finding is not surprising because manufacturing field remains a male-dominated career path. However, many of the women had a parent working in manufacturing and cited them as influencers, so it is surprising that the survey data did not show these items as greater influencers.
5. Although not quite a half a point difference (0.4), women tended to rate the recruiter getting to know them as less of an influencer than the men. This difference may indicate that more training and communication with recruiters on ways to influence women and build relationships during recruiting may be worthwhile.

## RESEARCH QUESTION 2

### *How are the recruiting practices at the sites aligned to the nine best practices?*

The nine best practices are divided into three focus areas: Inspire, Explore, Expand. In this section, we will review each practice, provide examples of how the three sites are employing these practices, and note areas for opportunity.

### INSPIRE STRATEGIES

- Reach out to middle and elementary school students
- Use targeted invitations—make it personal
- Design single-gender, small-group activities

As noted in the previous section, Tennessee and Indiana largely rely on invitations by local schools to present on the AMT program. Further, their recruitment efforts do not employ any of the three strategies to inspire young women to consider an AMT program. The three sites may participate in an annual camp or event such as a robotics competition for younger students to explore STEM, but they have no method to collect information about attendees and their interest in or desire for more information about AMT. They do not track contacts with potential students or make efforts for repeated visits. When the AMT instructor presents, they do not collect any information from attendees to gauge interest and rely on enrollment as their measure of success. The high school counselors are the primary driver for recruitment in Indiana and Tennessee. Without personal information, AMT recruiters cannot send personal invitations.



Despite a current lack of intentional programming for early recruitment, the instructors in Indiana stressed the need for early recruitment. One instructor remarked that many women grow up thinking they can only do certain jobs, but women can perform AMT jobs as well as any man and recruitment must start in elementary school to break those stereotypes. The program coordinator who also serves as an instructor in the program even ran for a local school board with the intent to push STEM. Both instructors stressed the importance of educating school counselors so that they understand that women can participate in the AMT program; aside from annual visits, however, there is no programming in place to introduce counselors and teachers to the AMT program. The dean of the Indiana program expressed an interest in taking counselors and teachers to the program classroom and plants to learn about the AMT job.

Texas, however, has a more robust strategy to engage students earlier and track their pathway to the AMT program. TX FAME has built a recruiting strategy that starts early and provides ongoing experiences for students in the form of camps, internships, programs, and dual enrollment. The schools do the bulk of the recruiting to enroll students in these programs, and the TX FAME program coordinator visits students in each of these programs to introduce them to the AMT program. He noted that he would rather talk to a room of 20 students who are already in STEM pathways than to an auditorium of 200 students. Because he targets his interactions via program enrollment at the school, he does not send personal invitations. However, he adds a personal note by learning about these students and developing relationships with them through classroom visits and one-on-one interactions,

and as they progress through the stacked and aligned opportunities. Students confirmed this interaction when they discussed his impact on their decision to enroll.

Title IX regulations on single-sex education and CTE have made the programs wary of single-gender activities or targeted recruiting. The program manager in Tennessee remarked, “We are not legally allowed to do any targeted recruiting, and single-gendered events would not be allowed.” Whether or not their interpretation of Title IX is accurate, the programs are proceeding with an abundance of caution. Overwhelmingly, program personnel at all three sites pushed back on the concept of single-gender activities, repeatedly stating that they are “gender-blind.” They stated they do not treat women differently than men and do not see the need to provide different supports or messaging based on gender.

### ***Gender-Blind – A comment from NAPE***

Gender-blind is an ideology where a person chooses not to see differences between genders. The concept supports the notion that equality, treating everyone the same, is the solution to the opportunity gaps we see in education and the workforce. The concept of equity is centered in providing each individual with what they need to be successful. To truly impact equity we must recognize that systems of oppression exist based on gender, race, ability, class, sexual-orientation and other characteristics and factor those impacts into the supports provided to students.

This apprehension highlights an opportunity to provide some education and clarity about how to conduct outreach to a single gender without fear of violating Title IX. What is

clear, however, is the research that shows the clear benefits of activities that support young women's exploration of STEM skills in a low-risk environment on their self-efficacy in STEM.<sup>2</sup> The Texas FAME internship program may offer examples of how to convene single-gender groups and provide access to same-gender, same-race role models. The internship program's small-group activities were not designed with gender in mind; however, high school students meet with AMT students who have just completed their first year, and students could experience some of the program in gender-based groups. Nevertheless, student and program personnel interviewees did not see the need for gender-based activities. The students acknowledged their perception that manufacturing is a male-dominated field, but they reported that they see other women in the field and that the men on their teams treated them as equals.

### ***Title IX: A comment from NAPE***

Although Title IX prohibits discrimination on the basis of sex in federally funded education programs and activities, regulations issued by the Department of Education authorize schools to offer single-sex classes or extracurricular activities under certain circumstances. The Title IX regulations that govern single sex public schools state that vocational schools that receive Federal financial assistance may never be limited to one sex and that vocational classes may never be offered on a single-sex basis. What is not clear from the guidance is whether single-sex activities, such as pre-vocational outreach activities, whether conducted by a school district or school or through another entity, are allowed under Title IX. We recommend that you consult counsel before embarking on any single-sex activity.

### **EXPLORE STRATEGIES**

- Use same-gender, same-race role models
- Provide repeated exposure to manufacturing careers
- Design interactive hands-on activities<sup>3</sup>

Repeated exposure and hands-on activities appear to be the most impactful strategies in the Explore group. All of the women noted that they were attracted to the AMT program because of its hands-on nature. They recalled recruiting events when they played with circuit boards or robots as a turning point that piqued their interest. In Texas, students can play with circuit boards and small robots during recruiting classroom visits. Tennessee hosts a robotics competition in which students design and drive robots during battle. The AMT students participate in the event and work with the students. The program coordinator found it noteworthy that more young women drove the robots this year than ever before.

The manufacturers also saw the benefits of repeated exposure and hands-on opportunities. Many of them offered annual tours for students and activities for students to play with technology. Manufacturers that could not have students directly engage in hands-on activities during a tour designed experiences that would be memorable and showcase the technology. At Ceco Door, students used a cannon that shoots out 2x4 boards and a wind simulator to test the doors' resilience during hurricanes or tornados. In the Toyota plant in Tennessee, students selected a song and programmed a robot to dance to the song.

Although annual tours and activities are a great start, the real power in this strategy lies with repeated exposure through stacked programs.

In Texas, the pathways developed from middle school to the AMT program provide students with repeated opportunities to learn and experience hands-on lessons related to the specific knowledge and skills needed to succeed in the AMT program. The vertically aligned STEM programming enables students to pursue ongoing coursework in which they worked in teams and with their hands and learned skills used in advanced manufacturing careers. These programs also allow repeat visits to develop relationships with students and extend recruiting efforts beyond single events with limited attendance.

As noted in the previous section on influencers, exposing students to same-gender, same-race role models is a beneficial strategy. Each program coordinator recognized that students relate more to their peers and strive to take women to recruiting events. However, programs with low participation of women can face logistics barriers in doing so, that is, pulling women out of class repeatedly for recruiting affects their own program experience.

The Indiana program has not developed an alumni network to leverage women who have successfully completed the AMT program or are working in the field to assist with recruiting. In contrast, the Texas program activates its alumni as recruiting partners and includes them on school visits. The role models were very important to the women interviewed in Texas; two were referenced repeatedly as strong supporters and mentors. The educational pipelines built in this region provided repeated exposure to manufacturing careers, interactive hands-on activities, and repeated events where students see women in manufacturing.

Based on the number of women who indicated they were inspired to explore the

AMT program by a friend or family member who participated in the AMT program or is currently employed as an AMT or other skilled worker in manufacturing, programs might consider how they can activate their alumni and family network, specifically women in that network, to assist with recruiting. Some of the manufacturers in Tennessee offer monetary bonuses to employees who refer people to work in the plants. Developing an incentive structure for alumni or current employees to inspire women to explore the AMT program could enhance recruiting and mitigate some of the staffing and logistics barriers noted in Tennessee and Indiana.

## EXPAND STRATEGIES

- Connect with parents/caregivers
- Partner with community organizations
- Create work-based learning opportunities

Although the programs employ no strategy to involve parents, the AMT instructors noted that students are often accompanied by parents on program tours. Parents and their children engage in hands-on activities in the lab as the program is showcased. One instructor in Indiana noted that he does not engage parents or caregivers on purpose, because he views the students as adults making their own choices. The other sites welcome parents, but have not developed parent-focused information or engage in strategic follow-up. Many of the women AMT students indicated that they learned about the AMT program through their parents or a guardian, so engaging parents could prove to be a valuable method for increasing recruiting efforts. Further, working with manufacturing partners to incentivize parents who are currently working

in manufacturing to encourage their children to explore the AMT program could also prove valuable.

Regarding partnerships, all of the sites are engaged in community outreach. In Tennessee, the program coordinator is part of a consortium of manufacturers who work collaboratively on workforce development. Indiana also has partnerships with college access programs, such as Upward Bound, and one of the AMT students we interviewed enrolled as a direct result of that program. The program coordinator in Indiana ran for a seat on a local school board to advocate for STEM programming. In Indiana, staffing shortages are a concern and barrier to recruiting. The program struggles to find instructors and has turnover, so the program coordinator is often required to teach courses in the department, which diverts time from deploying a full recruitment strategy. In fact, during its visit, our research team had to drive to a different campus in Indianapolis to interview the program coordinator, because he was called there to cover for an unexpected instructor resignation. This capacity issue greatly impacts the ability of the program to be visible and underscores the need to engage community partners to recruit.

In Indiana and Tennessee, the university's recruiting programs are designed to showcase all programs. Sites could benefit from developing programming that is tailored to the advanced manufacturing courses and from including local partners for a more comprehensive and robust recruiting program.

In Texas, community partnerships are a foundation of the recruiting program. The program coordinator has worked with area

middle and high schools to build and align curriculum and develop programming that leads to the AMT program. The schools have engaged their alumni networks to visit feeder schools with the program coordinator to promote these programs. Further, the Toyota plant in Texas offers a summer internship for students to work at the Toyota plant with current AMTs and learn the basics. This work-based opportunity has proven successful. One of the AMT students we interviewed participated in the program as a high school student, and all of the second-year students participated in the program as instructors for the interns during the summer after their first year in the AMT program. They noted that teaching what they had learned not only helped them feel more knowledgeable, but also gave them the chance to be an influencer for the young women participating in the internship. The program coordinator remarked that the internship served two functions: it inspired young women to enroll in the AMT program and accelerated, and it deepened the learning of the current AMT students teaching in the internship.

Developing relationships with community organizations, parents, alumni, and manufacturers is a critical component to a comprehensive strategy. Further, stacked programs and work-based experiences are highly effective in recruiting students and maximizing recruitment efforts. Indiana and Tennessee could benefit from learning more about how Texas FAME has used the explore strategies successfully to mitigate the capacity barriers that prevent more comprehensive recruiting that applies the nine best practices.



## SURVEY RESULTS RELATED TO RECRUITING EXPERIENCES

We included items on our survey to better understand the AMT program students' opportunities and experiences during their recruitment process. Students indicated how they learned about the AMT program (and could check all that apply). A total of 9 women, 84 men, and 1 individual who preferred not to select a gender completed the survey. The table

below indicates the number of respondents who selected a particular influencer and the percentage of the total number of respondents who selected a particular influencer. To maintain confidentiality, the single respondent who did not select a gender is represented in the total data only. The top three influencers are people rather than events and are highlighted in green. The top experience-based influencer was hands-on experiences related to manufacturing.

Influencer	Site	All (N=94)	Women (N=9)	Men (N=84)
<b>Personal invitations to attend recruiting events or informational sessions</b>	ALL	15 (16%)	2 (22%)	13 (15%)
	TX	3 (3%)	0	3 (3%)
	IN	5 (5%)	2 (22%)	3 (3%)
	TN	7 (7%)	0	7 (8%)
<b>Hands-on experiences related to manufacturing</b>	ALL	23 (24%)	2 (22%)	21 (25%)
	TX	6 (6%)	0	6 (7%)
	IN	7 (8%)	2 (22%)	5 (6%)
	TN	10 (11%)	0	10 (12%)
<b>Stories from a role model about a career in manufacturing</b>	ALL	19 (20%)	2 (22%)	17 (20%)
	TX	4 (4%)	0	4 (5%)
	IN	6 (6%)	2 (22%)	4 (5%)
	TN	9 (10%)	0	9 (11%)
<b>Repeated opportunities to learn more about the program</b>	ALL	14 (15%)	3 (33%)	15 (18%)
	TX	4 (4%)	2 (22%)	6 (7%)
	IN	6 (6%)	1 (11%)	5 (6%)
	TN	4 (4%)	0	4 (5%)
<b>Personal attention from a recruiter</b>	ALL	16 (17%)	2 (22%)	14 (17%)
	TX	7 (7%)	1 (11%)	6 (7%)
	IN	5 (5%)	1 (11%)	4 (5%)
	TN	4 (4%)	0	4 (5%)
<b>Woman-only recruiting events</b>	ALL	0	0	0
	TX	0	0	0
	IN	0	0	0
	TN	0	0	0
<b>A friend participated in the program</b>	ALL	28 (30%)	5 (56%)	23 (27%)
	TX	4 (4%)	2 (22%)	2 (2%)
	IN	10 (11%)	3 (33%)	7 (8%)
	TN	14 (15%)	0	14 (17%)
<b>A teacher/counselor recommended the program</b>	ALL	32 (34%)	2 (22%)	30 (36%)
	TX	6 (6%)	1 (11%)	5 (6%)
	IN	8 (9%)	0	8 (10%)
	TN	18 (19%)	1 (11%)	17 (20%)
<b>A parent recommended the program</b>	ALL	24 (26%)	1 (11%)	23 (27%)
	TX	4 (4%)	0	4(5%)
	IN	10 (11%)	1 (11%)	9 (11%)
	TN	10 (11%)	0	10 (12%)

In addition, students stated that the following helped them learn about the AMT program.

- One student participated in an Upward Bound program that toured the campus and introduced them to the program.
- Several students' parent or relative worked for Toyota and encouraged them to explore the program.
- In Texas, several students participated in the high school dual credit program housed on the same campus as the AMT program.
- One woman participated in the Texas FAME internship summer program.
- Two students' boyfriend/girlfriend recommended the program.

Personal invitations and attention is one of the nine best practices. The table below summarizes student responses to the question: How much personal attention or personal outreach did you receive during recruitment? Respondents were 84 men and 9 women.

	A lot		A little		None	
	Men	Women	Men	Women	Men	Women
TX	5	1	14	2	0	1
IN	6	2	11	2	3	0
TN	27	*	12	*	6	*

\* Only one woman is currently enrolled in the Tennessee FAME program, so her results are omitted from the disaggregated results to protect her data from being personally identifiable. Her data are included in the aggregate. In addition, one survey respondent who chose not to identify a gender is included in the aggregate but not reported separately to protect their identity.

Of the 94 respondents, 23 (24%) did not attend a recruiting events. Two women reported that they did not attend a recruiting event, and an

additional four women had not considered manufacturing as a career prior to participating in a recruiting event. These results underscore the importance of starting early and providing repeated experiences to help young women envision careers in manufacturing. 8 of the 23 respondents who did not attend any recruiting events reported they learned of the AMT program through a parent, 6 learned of the program through a school counselor or academic advisor, and 6 learned from a friend who participated in the program.

Including parents and caregivers in the recruiting process is one of the nine best practices, but 60 of the students (64%) reported their parents were not included in the recruiting process, including 6 of the women. One-half of the women who did not attend recruiting events learned about the program through a friend who participated in the program. These results underscore the importance of engaging parents and caregivers, partnering with schools, and engaging the alumni network as powerful recruiting strategies.

About one-half of the students (47) reported they had considered a career in manufacturing before attending a recruiting event, and 24 students (25%) reported they had not. The other 25% did not participate in recruiting events.

### Summary of Notable Findings

1. The most common way students learned about the AMT program was through friends who were either current or former AMT students and school counselors. This finding underscores the need to engage caregivers and partner with local schools.
2. Only about one-half of the students were planning to pursue a career in

manufacturing prior to attending recruiting events. Therefore, repeated exposure and consistent presence in schools is a high-powered strategy for inspiring students to explore the AMT program.

3. The top five ways students learned about the AMT program underscore the importance of engaging parents and caregivers, partnering with schools and organizations, and providing hands-on experiences.
  - 33% (31 students) learned about the program from a teacher or counselor.
  - 30% (29 students) learned about the AMT program through a friend.
  - 26% (24 students) learned about the program from a parent.
  - 25% (23 students) learned about the program from hands-on experiences related to manufacturing.
  - 20% (19 students) learned about the program from stories told to them by a role model about a career in manufacturing.
4. Only 15 of the students (16%), and only one of the women, received personal invitations to attend a recruiting event—a missed opportunity to inspire potential students to experience hands-on activities that could generate interest.

## RESEARCH QUESTION 3

### *What do the women experience in the AMT program classroom and on the job site?*

The AMTs across all three sites had positive feedback about their experiences in the program and on the job site with the exception of two AMTs in Tennessee who were from the first two program cohorts. As discussed above, the experiences of these women were not shared by more recent students, so it appears

that the culture is changing. One of the women from the first cohorts who graduated 9 years ago remarked, “We are ready for manufacturing, but we are not sure manufacturing is ready for us.” It is noteworthy that the two women who experienced harassment at their job site remain in manufacturing-related careers. One has become a process engineer at a different manufacturer, and the other is now teaching manufacturing courses. The former has found a place that is very inclusive and supportive of women. In fact, the plant’s workforce is 70% women, and the plant supervisor we interviewed said they have made many changes to make the job more family-friendly. The women in Tennessee focused heavily on the importance of family-friendly policies, and two of the manufacturers interviewed described changes to the shift lengths and overtime policies to promote work-life balance.

The women from all three sites discussed their team experiences in the classroom and job site in a positive light. They believed that they were valued on their teams and that the teams were more concerned about aptitude than gender. Several remarked that their teams look for the individual strengths of each member and assign tasks accordingly. Several indicated that the teamwork helped them see different perspectives.

One student in Texas remarked that having recent AMT graduates on her team was very helpful, because they were welcoming and helpful and she could relate to them. Another said she expected her job to be much more difficult since it is a male-dominated field, but she was pleased to find it was very easy to find her place and she feels that she will need to go through fewer steps to advance than she originally expected. Most of the women noted that the skills they are learning are transferrable



and can be used outside of work or to secure other types of jobs in the future. They remarked about the breadth of knowledge they were learning and that this would be helpful to them inside and outside of the job. They liked the problem solving required in the job and stated that they were challenged on a daily basis to find new solutions to problems.

Almost all of the women appreciated the ability to work with their hands, work while they learn, and work on teams. Some were focused on the ability to earn a wage, while others were focused on the ability to apply what they learn in the classroom in real settings in the plant.

*“The dual aspect of learning in school and on the job really offers many perspectives on the manufacturing field.”—AMT student*

*“We're all here for the great career opportunities this program provides, but I didn't expect to find friends so quickly within the program.”—AMT student*

Overwhelmingly, the students reported that they like the hands-on learning, the ability to apply what they learn at the job site, the friends they have made, and their work on teams. To understand the experiences of all AMT students, as well as how experiences differed between women and men, we asked students to respond to questions about their classroom and job site experience. The tables below summarize the average responses on a scale of 0 to 4 (0=not at all to 4=very much). Experiences rated higher by women than men are highlighted in green, with the opposite highlighted in blue.



Classroom experience and perceptions	Site	All (N=94)	Women (N=9)	Men (N=84)
<b>I feel supported to succeed in class</b>	ALL	4.0	4.4	4.0
	TX	4.0	4.3	3.9
	IN	4.1	4.4	4.1
	TN	3.9	*	3.9
<b>I am building my confidence in my abilities to succeed</b>	ALL	4.1	4.6	4.1
	TX	4.4	4.5	4.3
	IN	4.0	4.2	3.9
	TN	4.0	*	4.0
<b>I have opportunities to learn from other people like me (same race, gender, ethnicity)</b>	ALL	3.9	4.3	3.8
	TX	4.0	4.0	4.1
	IN	3.8	4.8	3.6
	TN	3.9	*	3.9
<b>I have changed my perceptions or misconceptions of manufacturing</b>	ALL	3.5	4.4	3.4
	TX	4.0	4.5	3.8
	IN	3.3	3.8	3.2
	TN	3.4	*	3.4
<b>I am encouraged to participate in class</b>	ALL	4	4.7	3.9
	TX	4.1	4.5	4.1
	IN	3.9	4.4	3.8
	TN	4.0	*	3.9
<b>I get to do activities that match my learning style</b>	ALL	3.8	4.1	3.8
	TX	3.8	4.3	3.7
	IN	4.0	3.6	4.0
	TN	3.7	*	3.7
<b>I have a greater understanding of the career opportunities for my future</b>	ALL	4.1	4.7	4.0
	TX	4.13	4.5	4.1
	IN	4.24	4.8	4.1
	TN	4.0	*	4

Job site experience and perceptions	Site	All respondents	Women respondents	Men respondents
<b>I feel supported</b>	ALL	3.8	3.8	3.8
	TX	3.8	3.5	3.9
	IN	3.96	4.8	3.95
	TN	3.8	*	3.8
<b>I feel encouraged</b>	ALL	3.7	3.8	3.7
	TX	3.7	3.3	3.8
	IN	3.84	4	3.75
	TN	3.6	*	3.6
<b>I learn about job opportunities for my future</b>	ALL	3.8	3.7	3.8
	TX	3.7	3.3	3.8
	IN	3.76	4.2	3.7
	TN	3.8	*	3.8
<b>I discuss my career goals with my supervisor</b>	ALL	3.1	3.1	3.0
	TX	2.7	2.3	2.7
	IN	2.88	4	2.65
	TN	3.3	*	3.3
<b>I am connected to resources to help me succeed</b>	ALL	3.8	3.8	3.8
	TX	3.9	3.3	4
	IN	3.6	3.8	3.45
	TN	3.8	*	3.8
<b>I am connected to a mentor or role models</b>	ALL	3.8	3.8	3.8
	TX	3.8	3.5	3.9
	IN	3.84	4.2	3.8
	TN	3.8	*	3.8

\* Only one woman is currently enrolled in the Tennessee FAME program, so her results are omitted from the disaggregated results to protect her data from being personally identifiable. Her data are included in the aggregate. In addition, one survey respondent who chose not to identify a gender is included in the aggregate but not reported separately to protect their identity.

Analysis reveals these notable findings:

1. Women consistently rated their classroom experiences higher than the men across all three sites.
2. Results for job site experience were mixed by location. In Texas, the men rated their job experiences much higher than the women. In Indiana, the opposite was true.

## RESEARCH QUESTION 4

***How has the increase in participation by women changed perceptions, added value to the classroom and workplace teams, and changed the culture within the program?***

Closing the skills gap requires a rethinking of manufacturing and who should participate in manufacturing careers. All three sites pushed back on the question of gender and said that hard work and perseverance are the key drivers for success. In Indiana, one instructor's success story focused on a woman who was not trying very hard until the last few months of her program. She started to study diligently to pass her final exams and she scored at the top of her cohort. Another said instructor stated that he tries to be "gender-blind" and rate students on their ability and work ethic. All instructors emphatically stated that women can do the job as well as men and belong in the field.

All instructors valued diversity in their programming and said that women bring different perspectives and skills. One instructor in Tennessee noted that the women are better problem-solvers and approach problems with more creative solutions. The other instructor noted that the women tend to stick with a problem longer than men do. In Texas, the program coordinator remarked that the AMT

women have helped to change the culture. In addition to the gender diversity, the AMT program has created more generational diversity with younger graduates working with older AMTs in the plants. He noted that the diversity has been a "breath of fresh air," and the men treat women with dignity and respect. His plant's shift from 1 to 35 skilled woman has been a game changer.

Instructors across all three sites noted that women excel in the program and often outperform the men. The program coordinator in Texas said that the women are natural leaders and have quickly moved through the leadership ranks. In Tennessee, changes have been mixed. Some plants have embraced women as equal team members; others have accepted them but relegated them to less technical tasks, such as sweeping and notetaking. The program coordinator is working with the various manufacturing partners to ensure that women are granted equal opportunities and equitable treatment.

In the classroom, the women AMT students did not perceive different treatment based on gender. They enjoyed working on their teams and believed that they were able to participate fully. One women did note, however, that she had to prove herself and advocate for more hands-on work. Several of the women in Tennessee recognized that they have to work twice as hard as the men to prove they can do the work. As noted earlier, their women's experiences in the plant varied. The women AMTs in Indiana and Texas work at Toyota plants, but those in Tennessee are placed in various plants and may be the only women AMT in the plant. This difference may partially explain why Tennessee report additional barriers due to gender. The students placed in teams already have good working relationships

and team experiences, which carry over into the plant if placed together. When a single AMT student is placed in a plant, they do not have the benefit of their group and must prove themselves to plant personnel who did not work with them in the classroom. Therefore, AMT programs may consider placing students in pairs or teams rather than individually, when possible.

During our interviews, the supervisors at four plants in Tennessee reported that they were very happy with the women in the AMT program and with women employees overall. Participation at the four plants ranged from 20 to 70% women, and each plant supervisor stressed that diversity is a strength and improves the plant's culture. They all praised the women AMTs as hard working, knowledgeable, and valuable.



## RESEARCH QUESTION 5

### *What gaps and barriers still exist, and how are the programs actively working to address them?*

Improving equity in the manufacturing workforce requires rejecting outdated thinking and stereotypes and embracing manufacturing as a viable career path for women. This shift begins by supporting women’s decisions to pursue a career in manufacturing and addressing barriers that prevent them from doing so. Survey results indicate that the women in the AMT program feel valued and have family and peer support. The only notable

difference between men and women, as well as the lowest rated survey item, relates to guidance counselors and teachers, indicating that working with educators to understand manufacturing would benefit recruitment efforts. Previous sections recognized that guidance counselors and teachers were large influencers that led students to enroll, so more education about the AMT program may reduce missed opportunities.

Several items on the student survey addressed the issue of obstacles and support on a scale of 0 to 4 (0=not at all to 4=very much). The table below summarizes the results. Where gender discrepancies exist, cells are highlighted in yellow.

Obstacles and support	Site	All respondents (N=94)	Women respondents (N=9)	Men respondents (N=84)
<b>Women are valued in my program</b>	ALL	4.2	4.0	4.1
	TX	4.2	4.3	4.2
	IN	4.3	3.8	4.4
	TN	4.2	*	4.2
<b>My family supports my decision to enroll and succeed in the AMT program</b>	ALL	4.4	4.1	4.4
	TX	4.3	3.5	4.5
	IN	4.5	4.5	4.5
	TN	4.4	*	4.4
<b>My friends support my decision to enroll and succeed in the AMT program</b>	ALL	4.2	4.2	4.2
	TX	4.2	3.5	4.4
	IN	4.1	4.8	4.1
	TN	4.3	*	4.3
<b>My high school teachers/ counselors supported my decision to enroll in the AMT program</b>	ALL	3.6	3.6	2.9
	TX	3.7	3.3	3.8
	IN	4.2	3.5	4.3
	TN	3.2	*	3.2

Analysis reveals the following notable findings:

Men's and women's ratings of support vary widely. While overall ratings were similar between women and men, discrepancies emerged by site.

- Women in Indiana tended to believe they were less valued in their programs than did men.
- Women in Texas have less family support than men.
- Women in Texas rated friend support much lower than the men, but women in Indiana reported more support from friends.
- Overall men reported less support from teachers and counselors than women, but, by site, women reported less support. Tennessee had twice the number of respondents as the other sites, so its results negatively skewed the aggregate results.

In Tennessee, much discussion about culture and stereotypes emerged. As described in previous sections, some of the women have faced harassment and hazing because of their gender, and many complained that they were not assigned the same work as their male counterparts. One survey respondent knew a woman who wanted to join the AMT program but chose not to enroll out of fear of being judged by men. A culture shift to value women in Tennessee manufacturing appears to be under way, because the more recent graduates and current students did not report the same experiences as women from the earlier cohorts. Further, the manufacturers spoke at length about valuing women and working to diversify their workforce. It may be useful for manufacturers to ensure the corporate and upper management view related to the value of women is being translated at the supervisor and employee level.

When asked whether any obstacles complicated their career progression or ability to participate fully in the AMT program, 19 students (20%) said "yes," including 3 women. Students who indicated "yes" reported the following reasons:

- Needed a driver's license to commute to the campus
- Mental health or medical issues
- Shyness
- Difficulty with the content

Students generally reported that their instructors were supportive and helped them overcome their obstacles.

*"I was a very shy person when I first started this program. Like SUPER SHY. I disliked talking to crowds and talking in front of a lot of people, which I still do, not going to lie, but I have improved a lot ever since I started this program. I am now capable of talking in front of crowds, but it doesn't mean I like it. I still dislike it a lot. But I've improved a lot ever since I overcame this obstacle."—AMT student (woman)*

*"I didn't understand how the process worked in my shop, but when I asked for help they gave it to me." —AMT student (man)*

A major barrier that emerged from the Tennessee interviews related to family-friendly policies. Three of the women have children and struggled to balance time with their children, childcare, and work hours. Plant supervisors in Tennessee reported that they are changing shift lengths and policies to make the job more family-friendly for all.

The students did not remark on ways that their instructors have helped them overcome these

barriers. One student said, *"The instructor was very supportive and the other said the instructor let me know how things will flow, how I need to relax some and learn at a steady rate."*

When asked about what the AMT program should consider to improve recruitment and retention of diverse students or improve support for current students, students offered suggestions aligned to the best practices. They suggested reaching out to younger students, targeting recruitment efforts to women and low-income students, becoming more involved in the community, conducting more repeated school visits, showcasing students more in their recruiting, providing hands-on activities, and increasing advertising to increase program exposure. Students commented:

*"I think they should reach out and put the information about the program out there more. I love the program and think it can give anyone the opportunity to have whatever future they want. The program allows you to graduate in two years with on-the-job experience in the maintenance industry."*

*"I think the AMT program should consider reaching out to more STEM focused schools and talk more about the program, because I only found out about the program through a quick HEB [local grocery store in San Antonio] slide show about manufacturing. And the last slide was about TXFame and it didn't go over much."*

*"In my experience, I haven't really come into contact with any recruiting events. And the people I know that have gotten in are usually by word of mouth from family or friends."*

Regarding retention, students offered a lot of feedback about the program structure, with financial burden emerging as a common theme among men and women. One woman student suggested "changing overtime rules to make it overtime pay after 8 hours even before working for 40 hours. Only working 2 days per week and no chance of achieving overtime hours makes it hard to have an income to live on while paying for school." Another student recommended that the program allow students to transfer dual credits from high school programs as a way to reduce the tuition load. One man student commented: *"Some sort of reimbursement or payments towards college, the amount of hours we receive with the pay and the fact we don't get overtime rates leave the AMTs who don't have a good financial support system stranded, paying for gas, housing, education, meals for work, laundry. It's intense, if I had the time I would take a second job to pay for this, but in the end it is worth it with the pay and career I will receive but right now it is a struggle."* Another student suggested that program start a carpool program so that students can save money on gas and transportation. Of note, Texas' [AlamoPROMISE](#) covers tuition and required fees for current academic year graduates from participating high schools seeking an academic certificate or associate degree at one of the five Alamo Colleges: Northeast Lakeview College, Northwest Vista College, Palo Alto College, San Antonio College, and St. Philip's College. As Alamo PROMISE Scholars, students meeting eligibility criteria receive a "last-dollar" scholarship for up to three years or the completion of an associate degree or academic certificate, whichever comes first. The "last-dollar" scholarship funds the cost of tuition and required fees after financial aid awards are applied.



Another theme related to communication between the program and the plant. Students suggested more site visits and better training for the plant supervisors who work with the AMT students. One student noted, "Most employers lack the ability to mentor and help young students." Another student suggested, "A monthly or once a semester report from each shop such as an email or in person meeting between our VEC supervisors. Going over how our learning process is going between school and work." Based on the comment, the research team assumed that a VEC supervisor is the plant supervisor directly responsible for working with the AMT students. Finally, students in Indiana noted that instructor turnover is a barrier to recruitment, and students from all sites noted large differences in the quality of instruction from site to site.

When asked whether their long-term goals include a career in manufacturing, 9 of the students said "no" and another 23 said they were "not sure," that is, only 66% of the current students are sure they want to remain in manufacturing. Several of the plant supervisors in Tennessee described working with their employees to identify their interests and to help them find the most rewarding and suitable jobs, but survey results show that this practice is not widespread. The item asking whether students discuss career goals with their supervisor scored only 3.1 out of 5.0. The table below shows the results from this question.

		All	Women	Men
I discuss my career goals with my supervisor	ALL	3.1	3.1	3.0
	TX	2.7	2.3	2.7
	IN	2.88	4	2.65
	TN	3.3	*	3.3

Perhaps more career guidance could help students commit to a long-term goal to remain in manufacturing. Periodic surveys of the students to determine why they are not sure of their future goals could also be informative.

Analysis of the student responses revealed the following notable findings:

- A more comprehensive and long-term recruiting strategy could greatly enhance the participation of women and underrepresented people.
- The program should work more closely with employers and address financial burdens that create hardships for students and can impact retention.
- As stated by one woman, "[Women] are ready for manufacturing, but I am not sure manufacturing is ready for [women]." These case studies confirm that conditions for women are improving and in some cases women are reporting more support in the classroom than men, but much more work can be done to attract and retain women in AMT programs. The nine best practices are a great place to start when designing a more comprehensive recruitment strategy.

## CONCLUSIONS AND RECOMMENDATIONS

These three case studies explored the following research questions:

1. What people or messaging influenced women to explore careers in manufacturing?
2. How are the recruiting practices at the sites aligned to the nine best practices?
3. What do the women experience in the AMT program classroom and on the job site?
4. How has the increase in participation by women changed perceptions, added value to the classroom and workplace teams, and changed the culture within the program?
5. What gaps and barriers still exist, and how are the programs actively working to address them?

This study confirmed that a comprehensive, collaborative, regional recruiting strategy is needed to increase participation of women in AMT programs.

### INSPIRE

Under the inspire strategies, early exposure to STEM and manufacturing appears have a great return. When young women have access to programs and courses that introduce and engage them in STEM, they cite these experiences as major influencers that led them to the AMT program. Targeted invitations appear to be less important than personal recruitment, so it may be worthwhile to revise this strategy to “Make it personal with targeted invitations as a sub-action.” Most of the recruiting is driven by invitations from schools to the AMT program representative to present

at schools or in classes within STEM programs. None of the sites personally invited students to events because they do not collect their personal information and do not have access to it. However, school counselors play a large role in directing students to these programs where AMT recruiters meet students. Therefore, any recruiting strategy should include outreach to school counselors, so that they understand the benefits of manufacturing and that women are capable of working as an AMT.

Any recruiting strategy should consider approaches to repeated visits to enable relationship-building. Making personal connections and visiting often matters. Recruiters should strive to visit students multiple times over as many years as possible to build relationships with them and learn about them. When repeated visits and personal relationships were formed, the women cited these relationships as major influencers of their decision to enroll.

Single-gender, small-group activities appears to be problematic for recruiters. Because of anxiety around Title IX regulations, recruiters are either not allowed to, or are uneasy about, targeting a specific group of students for recruiting. Across the board, the program personnel and recruiters said that they treat all recruits the same and do not vary their approach based on gender. Although this strategy is based on significant research supporting its value, the current political climate and unclear guidance on single-sex outreach activities suggests that CTE educators seek counsel locally. Most of the program personnel, instructors, and recruiters showcased their women AMTs during recruiting events, but, beyond, that did not attempt to group students according to gender and were not willing to do so. Perhaps

partnering with Girl Scouts or other groups that exclusively serve young women could provide opportunities for activities with single-gender groups.

## EXPLORE

All three of the explore strategies appear to have a large impact on young women's decisions to enroll in the AMT program. Showcasing women in manufacturing during recruiting events, designing experiences in which students work with women AMTs, and creating opportunities for hands-on activities were all major influencers. Creating stacked programming or other ways to ensure repeated exposure with students who are engaged in STEM realizes a high return on investment and reduces the burden on one organization to recruit.

Overwhelmingly, the students value hands-on work and cited hands-on experiences as influential. More outreach with repeated exposure to manufacturing with hands-on activities could enhance recruiting. The Toyota summer internship is a great model for providing exposure and experience to women who may be interested in a career in manufacturing.

Showcasing women in manufacturing is a missed opportunity for the programs. Although the program coordinators strive to take their women AMT students to recruiting events, leveraging leaders at the partner manufacturers would add value to their efforts. Developing partnerships with manufacturers that have women leaders and engaging those women in recruitment would result in a high return on investment.

## EXPAND

Finally, the expand set of strategies is imperative for a comprehensive recruitment strategy. The programs have limited time and resources to recruit on their own. Partnering with local schools and helping them develop educational pipelines can provide opportunities for repeated exposure, relationship development, and hands-on experiences.

The Texas FAME chapter has strong pipelines and partnerships with local school districts and area STEM programs, so many of the students were influenced from an early age by participating in these programs. The TX FAME program director remarked that his backyard strategy for recruiting began by fostering programs at the local middle and high schools and working to help those schools create curriculum that would align with FAME's AMT program. He noted, *"You can't recruit everyone, and you can't recruit no one."* He would rather speak to a 20 students in a class that is building relevant skills for the AMT program than speak to 200 students at a career fair. He focuses his time on being visible in the classrooms that naturally feed into the AMT program, so that he has repeated opportunities to talk with those students. Developing a pipeline that begins in middle school can help retain young women who are interested in STEM and provide a career pathway through high school that leads to the AMT program and ultimately a career in advanced manufacturing.

Finally, these case studies underscore the value of engaging parents and caregivers. Many of the students were inspired to enroll by their parents, so ensuring that parents are informed about the AMT program and engaged in recruiting would positively impact enrollment.

## LIMITATIONS

The findings in this report are based on three case study sites. One site is in a rural area in Tennessee, one is in rural Indiana, and one site is near the urban area of San Antonio, Texas. Although some clear differences emerged based on urbanization, the small sample size makes generalizing these differences impossible.

Although participation in the AMT program for women is increasing, the number of women interviewed in this study is small and warrants additional investigation to determine whether the emerging trends noted in this report are widespread. Because only one woman is currently enrolled in Tennessee, her survey results were not reported to protect her privacy.

The AMTs interviewed from the Texas and Indiana sites work at Toyota as their co-op, while the students in Tennessee are placed in multiple plants. We interviewed former AMT students in Tennessee, but their experiences did not occur during the same time. Some of the women graduated up to 8 years ago, so their perceptions are not current. However, they provided a perspective of how perceptions and opportunities are changing for women in manufacturing and how their experiences differed based on the plant they worked in.

We interviewed four of the partners in Tennessee, including the Toyota Motor Manufacturing supervisor, but we did not interview plant supervisors at the Toyota plants in Texas or Indiana. Three of the four employers we interviewed do not currently have AMT students in their plants, but all of them employed AMT students in the past and

are interested in employing more in the future. Further, we interviewed the FAME coordinator in Texas, but the FAME coordinator in Indiana asked not to be interviewed. In Tennessee, the program coordinator is from the university, and no coordinator from Toyota is actively engaged in recruiting.

The scope of this project focused on the student experience, but a deeper study on the manufacturing partners and program coordinators would be interesting, specifically to better understand how culture around manufacturing is changing. It would also be interesting to interview and/or survey school counselors and teachers to better understand their perceptions of manufacturing and the stereotypes they may hold about who belongs in the AMT program and how that perception influences the way they counsel students about future opportunities in manufacturing.

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<sup>1</sup> Employed persons by detailed industry, sex, race, and Hispanic or Latino ethnicity; Labor force statistics from the Current Population Survey. Bureau of Labor Statistics. Retrieved from <https://www.bls.gov/cps/cpsaat18.Htm>

<sup>2</sup> See the research at <https://www.ncbi.nlm.nih.gov/books/NBK555387/>  
[https://nap.nationalacademies.org/resource/25585/Commissioned\\_Paper\\_Pietri.pdf](https://nap.nationalacademies.org/resource/25585/Commissioned_Paper_Pietri.pdf) (p. 29).

<sup>3</sup> Questions and Answers on Title IX and Single-Sex Elementary and Secondary Classes and Extracurricular Activities are available at <https://www2.ed.gov/about/offices/list/ocr/docs/faqs-title-ix-single-sex-201412.pdf>



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