Impact of Student Tours of Manufacturing Facilities

Dr. Marilyn Barger, National Science Foundation ATE Centers

Dr. Marilyn Barger is the principal investigator and executive director of FLATE, the Florida Regional Center of Excellence for Advanced Technological Education. FLATE is funded by the National Science Foundation and has been housed at Hillsborough Community College in Tampa, Florida since 2004. FLATE serves the state of Florida and is involved in outreach and recruitment of students into technical career pathways; has produced award-winning curriculum design and reform for secondary and post-secondary career and technical education programs; and provides a variety of professional development for STEM and technical educators focused on advanced technologies. She earned a B.A. in Chemistry at Agnes Scott College. She earned both a B.S. in Engineering Science and a Ph.D. in Civil Engineering (Environmental) from the University of South Florida, where her research focused on membrane separation science and technologies for water purification. She has over 20 years of experience in developing curricula for engineering and engineering technology for elementary, middle, high school, and post-secondary institutions, including colleges of engineering. Dr. Barger serves on several national panels and advisory boards for technical programs, curriculum and workforce initiatives, including the National Association of Manufacturers Educators’ Council. She is a Fellow of the American Society of Engineering Education, a member of Tau Beta Pi and Epsilon Pi Tau honor societies. She is a charter member of both the National Academy and the University of South Florida’s Academy of Inventors. Dr. Barger holds a licensed patent and is a licensed professional engineer in Florida.

Dr. Richard Gilbert, University of South Florida

Richard Gilbert is a professor of Chemical and Biomedical Engineering at the University of South Florida’s College of Engineering and a co-principle investigator for FLATE. The Florida Advanced Technological Education (FLATE) Center is a National Science Foundation Regional Advanced Technological Education (NSF-ATE) Center of Excellence with a statewide mission to help colleges within the Florida State College system maximize the skills and STEM impact of their A.S. degree programs that address the production of a technical workforce to meet the needs of Florida’s high tech sector. Dr. Gilbert’s applied engineering research interests are focused on electric field mediated drug and gene delivery. He has publications in this area and holds over a dozen patents tied to licensed technology related to applicators and delivery protocols.

Dr. Marie A. Boyette, FLATE

Marie Boyette is the associate director of FLATE at Hillsborough Community College. Dr. Boyette earned her B.A. in Communication, M.A. in Adult Education. Her Ph.D.s in Curriculum and Instruction/Measurement and Research, and Adult Education are from the University of South Florida. Her research interests are in STEM curriculum development and student outcomes as well as in experiential learning for career and technical education and training. Developed and deployed concepts include creating an annual “summer camp style” workshop for teachers covering the topics of alternative energy, integrating the technology and engineering side of STEM into mainstream curriculum, and engaging girls in STEM curriculum.
Introduction

Since 2005, the Florida Advanced Technological Education Center of Excellence (FLATE) has conducted 167 tours to 75 different Florida manufacturing sites, introducing 3,917 middle, homeschooled, and high school students and 435 teachers and parents to the world of modern manufacturing. We have surveyed over half of participating students (2,369) after the tours to find out what the students experienced from their own point of view. One of our goals has been to provide students with exposure to real STEM workplaces, primarily those in manufacturing. Modern manufacturing is a misunderstood industry sector that currently has a large number of unfilled technical and high paying positions that companies are finding difficult to fill across the country. The jobs are extremely varied, exciting, and challenging. The majority of these jobs are found in highly automated, high tech, and very clean facilities. These high tech jobs are growing, are high paying, and now require some level of post secondary education from community college technical associate degrees to post baccalaureate degrees in all STEM disciplines. They offer wonderful careers pathways, many promotion possibilities, and promote opportunities leading to great lifestyles.

This paper shares FLATE’s processes for organizing and deploying effective student tours of manufacturing facilities and how to determine the impact they have on students and educators. It includes anecdotal evidence based on feedback from students, industry hosts, staff, and teachers as well as aggregated survey results from eight years of student tours of manufacturing facilities. Our feedback and findings overwhelmingly support the importance of exposure to real world work environments and real people doing real jobs for the next generation manufacturing workforce.

Defining an Industry Tour

FLATE’s outreach initiatives regularly engage middle and high school students in tours to high tech industries using several operational models: (1) FLATE’s traditional “Made in Florida” Industry Tours, the “1-to-1” model, for middle and/or high school students where a student class together with a teacher and chaperones are transported by bus to participating partner industries; (2 and 3) the multisite “Industry Day” models or the “1-to-many” and “many-to-many” models in which multiple high school student groups tour two or three manufacturing sites in one day including lunch at one of the facilities; and (4) tours for private and home schools where parents provide the transportation and also participate in the tour. In 2013, FLATE will launch a fifth model, the “many-to-1” where students from multiple schools will converge on a single factory on the same day for a tour. The tour models described work for different stakeholders – and that is one of the keys to success – know your “customers.”

Table 1. FLATE Tour Models

<table>
<thead>
<tr>
<th>MODEL</th>
<th>DESCRIPTION</th>
<th>TIME</th>
<th>PARTICIPANTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-to-1</td>
<td>One school class to one site</td>
<td>Half day</td>
<td>Students, educators, manufacturers</td>
</tr>
<tr>
<td>1-to-many</td>
<td>One school group to 2 or more sites</td>
<td>Full day</td>
<td>Students, educators, manufacturers</td>
</tr>
<tr>
<td>many-to-many</td>
<td>2 or more school classes to 2 or more sites</td>
<td>Full day</td>
<td>Students, educators, manufacturers</td>
</tr>
<tr>
<td>Home school</td>
<td>one group to one site</td>
<td>Half day</td>
<td>Students, educators, parents,</td>
</tr>
</tbody>
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Industry hosts need help to prepare for student visitors, since they may be inexperienced in dealing with groups of students and the levels of knowledge and experience that young people have. Also, it’s important to know what their constraints are and honor them regarding time, rules, and regulations. Schools also have constraints for days and times and even “better” or preferred months during the school year and even times of day for students to leave a school. Listening to these stakeholders and honoring their constraints and limitations is one step in organizing a good and effective tour.

The Tour Process (before, during, after)

Generally, a tour process has three stages: pre-tour planning, the tour event day, and post tour follow up and activities. All of these are equally important to provide good experiences for all participants (industry hosts, students, parents, and teachers, and third party organizers or sponsors). Generally, to provide a good tour experience for all, be sure to start six to eight weeks before the event, honor all timing constraints, and follow a checklist and timeline for the event.

Start the process with lining up a good match between a school program and a company. Know what the company does, what it makes, how much time they need or want to have the students visit (usually 60-90 minutes), what areas of the plant the students will see, and generally, what the host can offer for the tour. For example, if the company makes components for aircraft or aerospace, an aeronautics or aerospace focused technical program might be a good fit, but that career academy or program might not be as good a fit to a food processing plant. The pre-tour process also provides preview information that can be passed along to the students directly or via the educator/chaperones prior to their visit.

There are other ways to help maximize the impact of a manufacturing tour for students and educators alike. Provide educators and students with in-depth information about the company, as well as a good overview of manufacturing and production industries within a week or two of the scheduled tour. It’s a great idea for the coordinator and/or educators to visit and/or tour the potential tour site prior to the student visit. This offers an easy and fun way to know exactly where students will be, what they will see, about how long it will take, what restrictions there are, etc. Additionally, manufacturing processes and operations are not generally covered in school curricula. Encourage the teacher or teachers to do a lesson and/or discussion before the actual tour on “what is manufacturing” and explore the kinds of products and processes the students will see on the tour.

Although there is little data on student learning after field trips and tours, a small 1995 study by Bracey documents what may seem obvious. Bracey offered the same field trip to three student groups in the same course. One group (the control) had no preparation for the field trip, similar to most traditional field trips. A second group was prepared for the tour using a hands-on activity related to the field trip. The third group had instruction on the field trip, but no hands-on. After the trips, the students with the hands-on preparation had higher performance when tested on the field trip materials. There are good, free educational resources and lesson plans online for teachers to review and download. Most are good and cover the basics of generic manufacturing
and will help the students and teacher to have a more meaningful experience. A tour facilitator can help educators find and use these materials, or develop their own for a more meaningful tour.

The second part of the “pre-tour” activities includes all the logistics of date and time, transportation, school forms, company forms or lists, and preparing students. There are many details to be aware of when supervising minors on such an outing. Educators in the school systems are very familiar with these, but both industry hosts and third party organizers need to be aware of the same. For the schools, scheduling is all about timing during the school year and during the day. Let them tell you when is a good time during the school year and also what time of day and/or what days of the week are preferred. School contacts can also provide necessary paperwork for the students that would include permission slips, photo releases, etc. Companies may have guidelines for age and/or number of students per group and even citizenship requirements. A final pre-tour logistic item should include a reminder email or phone call to all parties (host, students, teacher, transportation coordinator, etc.) with details needed for a smooth rendezvous at the appointed time and place on the tour day, including cell phone numbers and emergency contacts.

The day of the tour brings all the pieces together. The tour coordinator should ensure that all participants arrive on time and know exactly where to go upon arrival. A teacher might have to double check parent permission slips, identification (if required) and that students meet any required dress code. The coordinator might ride the bus with the students or meet the participants at the tour site. Be sure to confirm that the school or private bus knows the location, best route and knows how long the program will be. Be sure that the students have been given an overview of the company and manufacturing and know if they can take photos or not. Help students and teachers develop questions and be sure to have questions to ask them, so they can verbalize their impressions and thoughts. Distribute any “giveaways” and have students fill out the student surveys before they leave. Be sensitive to the time constraints of all involved: transportation vendor, school and the company.

After the tour, thank you notes or emails are important. Companies like to be involved with their communities, and its important to acknowledge that formally. Share any photos you were able to take. Tally the student survey results and send a summary to both the host company and the teacher or chaperone of the student group. Provide a link to specific online educator resources so they can continue the conversations about manufacturing jobs. Be sure that the school contact and someone from the company are connected with an email, as tours often seed school-industry partnerships that can grow to include more interactions between the two. Foster that connection, if at all possible. Ask the industry host personnel involved in the tour to provide feedback by survey or phone interview.

FLATE “Made in Florida” Industry Tours

In 2005, FLATE had the opportunity to work with manufacturers to bring middle and high school students into their facilities in central and west central Florida. FLATE’s first tours were set up in the greater Tampa Bay area and greater Orlando area. There are a large number of manufacturers in both of these densely populated metropolitan areas and existing contacts with the regional manufacturers in those areas helped establish the manufacturing connections. After
six months, those involved with organizing these first “Made in Florida” Industry Tours debriefed the experiences of the first dozen tours, capturing feedback from students, educators and industry hosts. A “Made in Florida” tour process and timeline was drafted to standardize what and how FLATE personnel organized tours and ideas to optimize the experiences of all students visiting industry sites. A very short online survey for industry hosts was also developed with 5 short answer questions to get feedback from industry. Through 2008, all “Made in Florida” tours were comprised of one school group visiting one manufacturer in a half day event. A set of student informational handouts were developed and included the following: job, education requirements and wage information, information about what is manufacturing, list of local companies and what they make, handout about robotics in manufacturing and links to FLATE’s new outreach website: www.madeinflorida.org. This website is dedicated to outreach for manufacturing education and also hosts a streaming version of the “Made in Florida” video in English and Spanish. In response to continuous stakeholder feedback providing new constraints or new opportunities, the tour process and handouts have evolved over the years.

Much of the “Made in Florida” tour process is defined in two documents. The first is a published FLATE Best Practice Guide “Middle and High School Field Trips to Florida’s High Technology Manufacturing Facilities” that captures lessons learned and is available as a free downloadable file on the FLATE website (www.fl-ate.org). It is intended to help interested organizations, such as the regional professional associations and other STEM education focused organizations plan, conduct, and follow-up successful student tours. The second document is an internal FLATE document that contains details, file locations, timelines for vendors and participants. This document is used specifically by FLATE staff, partners and volunteers. Student handouts, student, parent and industry host survey files and links, along with other resources can be found online at www.flate.pbwiki.com under “Make-a-Tour Take-a-Tour” icon.

Figure 1 shows our tour history with both the number of tour events and total number of student participants per year. The sharp decline in the number of participants in 2007 and 2008, strongly reflected the very unstable fiscal environments that schools found themselves in with drastically shrinking budgets and new state requirements. During the recent recession, companies faced their own challenges in the unstable and shrinking economy many minimized their community involvement activities, including industry tours. To respond to the new norm, FLATE worked closely with manufacturers, school districts and teachers to develop new tour models that would work for different stakeholders. By 2012, manufacturing had risen in popularity and was seen as a key business sector to help end the recession. Responding to this national optimism, companies became interested again in hosting tours, and school programs became interested in touring manufacturing sites. To increase community awareness of manufacturing along with student and educator awareness, a shift to more “Industry Day” (one-to-many and many-to-many) events was made. These events sometimes also involve local or state politicians or dignitaries. These larger scale events often catch the attention of local media,
resulting in news stories in print and online, which is great promo for the schools and industry involved.

Figure 1. “Made in Florida” Industry Tours 2008-2012

![Tours by Event and Participant Count](chart)

But, are these tours having a positive impact on the way students view advanced manufacturing careers? The student survey data shows an unequivocal YES. FLATE compares *strongly agree* and *agree* student responses to two questions in our survey in order to consider the impact of a student tour of a company:

10.) I was considering a career in manufacturing before the tour.
13.) I am now considering a career in manufacturing or related technical industries.

Cumulative data (2005-2012) for collected surveys shows a 36% positive change in agree responses toward consideration of a career in a high tech manufacturing after the tour (n = 2,369). The 2012 survey data shows a 41% (a 5% increase over the five-year cumulative) in positive change for agree responses toward manufacturing career interest (n = 412). This percentage indicates a definite increase in tour impact on student perceptions of advanced manufacturing careers.

Responses to two other questions also reflect strong positive impact on the students. Sixty percent of the 2,369 responses since 2005 strongly agreed that the tour gave them important information about manufacturing careers (Question 9). Additionally, just over eighty percent of this
group agreed or strongly agreed that they would recommend this tour to other students (Question 12). In response to question 15 “I am now more committed to making more of an effort for success in STEM studies at school,” over 60% strongly agreed or agreed; full break out of responses are captured in Figure 2. Student responses to other survey questions also indicate high levels regarding their perceptions of the relevance of the tour and heightened awareness of the importance of manufacturing skills.

Figure 2. “Student Survey Results After a “Made in Florida” Industry Tour

Studies show that the #1 influencer on high school students’ career choice is their parents! Additionally, a survey on the public perceptions of manufacturing reveals that only 35% of the responding public said they would support a career in manufacturing for their children despite their responding strongly that they believed that manufacturing is very important to the US economy and has high technology jobs (Deloitte, 2012). Therefore, providing parents with accurate information is vital to be sure that today’s students seriously consider manufacturing careers. Parent participation in industry tours is one very good way to provide some knowledge directly and impress them with the richness of many manufacturing careers. They can see and even hear directly from manufacturing professionals that overall, they like their jobs, find them challenging and stimulating, offer opportunities for advancement, and that these jobs can be financially lucrative.

A small sample comprised of thirteen parents of home school students participating in 2012 tours were surveyed with responding parents overwhelmingly recommending the tours for other students. One hundred percent responded that they strongly agreed or agreed that they found the work interesting and that they now had positive opinion about careers in modern manufacturing. Additionally, nearly all strongly agreed that they would support a career in advanced manufacturing for their child. Very importantly, all but one of the 13 parents attending one of the most recent tours were able to see how the “STEM (science, technology, engineering and mathematics) subjects learned in school are put to work in high tech industries.”

Who gives the tour, also surfaced as an important point from the results of the two parent surveys. One tour was at a high tech machine shop that makes components for the aerospace industry and production professionals conducted the tour. The second was at a food processing
facility with a staff tour guide, who had little direct experience with the actual production operations. The tour focused on production processes of the company products and the tour guide did not provide any insight about the particular jobs or required education and skill sets of any of the production jobs the touring students and parents saw on the floor. Survey item nine stated, “This tour gave me information about careers in advanced manufacturing.” Ninety-two percent of the parents on the tour led by production professionals at the machine shop strongly agreed with the statement. Only 72% of those on the food processing tour strongly agreed to the same statement. Although the sample size was extremely small, the results point out that it is important to have someone well versed in various manufacturing careers and jobs at the facility conducting the tour.

Future Tour Improvements

In 2012, FLATE increased both the number of events and participants in tours to advanced manufacturing facilities. Several factors added to this upturn: FLATE increasing the number of its Industry Day multi-site model tour offerings to more school programs, a partnership with Bay Area Manufacturers Association (BAMA) and county school districts offering a new STEM Goes to Work tour model, expansion of tours into south Florida (Hendry County), an increase in the number of FLATE summer camps (tours are offered as part of the camp experience), and more requests for tours were received from middle and high school teachers.

Future plans to raise the impact of tours include working even more closely with teachers prior to tours to ensure that they are aware of and know how to use pre-tour lesson plans and activities; survey teachers and parents accompanying students on the tours for feedback; extending the scope of tours by encouraging post tour class lessons, activities and debriefing. Additional efforts will focus on continuing to scale up the number of locations and numbers of students through regional organizational partnerships. Finally, it is also important to continue sharing best practice tour models; to continue incorporating tours into other events such as summer STEM and robotics camps to increase scope; asking companies to do a post tour visit to the school; exploring regional manufacturing expos as a different kind of “tour model,” encourage the production of and use of virtual online tours; explore strategies to better connect tour experiences to college and career pathways; and, use tours to seed long-term, self-sustaining school-industry partnerships.

These are exciting times for manufacturing. Tours to Florida high tech manufacturing industries expose not only students, but also their parents and teachers to the positive aspects of advanced manufacturing careers, and the education needed to obtain these careers. Tours should be integral parts of the secondary and post-secondary manufacturing and technical courses and programs. They can also easily be integrated into the classroom curriculum by teachers with help from the industry host and by aligning the tour to student learning objectives and help integrate technology and engineering into mainstream and STEM course objectives. Making it meaningful, making it part of the curriculum, and making it fun are equally important to achieving the maximum impact for students.
Bibliography


Appendix

Tips for Industry Tour Hosts

• Give a preview tour to the educator chaperone if possible before the student tour
• Find out what kind of class/course will be visiting and what age
• Remember “tabula rasa” - they know little about what you take for granted
• Outline both your introductory remarks as well as tour highlights
• Develop a list of questions (possibly with the teacher) to ask students during the tour
• Talk about the processes as well as the flow
• Have something they can touch and/or hold, or a hands-on demonstration
• Talk about careers and technical jobs in the plant
• Talk about the importance/relevance of education and training for various positions
• “Give aways” for students and/or educators are great (might not be the same)
• Give students an “assignment” - something to research, etc.
• Follow up with the educators afterwards to see if there are more questions
• Consider what you would do differently the next time