

Making It Work: Gainful Engineering Education and Recruitment through Industry Engagement

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Abstract

The application of technology in manufacturing is growing rapidly and sharp young students are needed to fill these mission critical jobs. This consideration was the prime motivator for the development of the “Making It Work” (MIW) Manufacturing & Engineering Fair. MIW exposes the brightest young minds to the wide diversity of job opportunities available in local manufacturing operations. Students who participate in the fair learn about high-paying manufacturing, technical, and engineering career choices. Participants also meet local graduates who are successfully working in these operations. Local manufacturer’s sponsor the event and tend a booth at the fair to showcase their products, manufacturing processes, and job skills required at their facility. In addition, participants are able to visit with representatives from North Carolina (NC) colleges, universities, and workforce development boards. The day long fair consists of a real world engineering design and problem solving competition. The purpose of MIW is to create awareness and build excitement among local high school juniors and seniors about career opportunities in manufacturing. The long-term outlook for manufacturing in the foothills of NC is strong. The need to develop a locally grown skilled capacity that can help resident manufacturers remain competitive, leverage new technologies, fill the gaps of an aging workforce, and continue to grow a manufacturing base is apparent. The fair is an opportunity for companies to plant a seed that might grow into a valuable and knowledgeable employee. Approximately 200 participants attend MIW each year. Participant satisfaction rates have been consistently high over the last three years with a 98% overall quality rating of the fair. The unique characteristic about this fair compared to other models is the comprehensive industry engagement. The MIW fair is planned, sponsored, and carried out by local industries working together to ensure their future employment needs are met. The event takes place at different industrial sites each year giving students a true glimpse at what it takes to make it in the business. The model outlined in this paper serves as a tool for other institutions who are looking for a renaissance in their own recruitment strategies and professional networking.

Keywords

Interest gap, workforce development, industry engagement

Introduction

Manufacturing Day is an annual affair acknowledged in states across the nation each year on the first Friday of October. In NC, governing political bodies embrace the Manufacturing Day experience and encourage local events statewide. Many events take place in the form of a traditional career fair type setting where students are shifted through a large room with vendors

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set up at a 4' x 6' table with a limited time to speak and very little representation of what the industry actually involves. The difference in the “Making It Work” (MIW) Manufacturing & Engineering Fair is the venue and the synchronization with all stakeholders from industry to education to economic development and workforce boards. The 2014 event was recognized as finalist for the Advanced Manufacturing Awards Best Collaboration by the Charlotte Business Journal. This awards program celebrates process excellence, leadership and collaboration in Advanced Manufacturing displayed in the Charlotte region. Charlotte Business Journal, along with partner, Centralina Economic Development Commission, recognize companies and individuals who are making significant contribution to the promotion of manufacturing.

The 3rd Annual “Making It Work” Engineering & Manufacturing Fair was held on October 3, 2014 at Rockwood Lithium in Kings Mountain, NC. The event, held in conjunction with National Manufacturing Day, exposed 200 high school students from Cleveland and Rutherford counties to 14 manufacturing companies from the region and representatives from four NC colleges and universities. Students learned about manufacturing and engineering job opportunities available in the region and were able to talk with manufacturers about their products, manufacturing processes, and what job skills are in demand at their locations.

The event began with an introductory presentation including a key note speech from John Mitchell, Rockwood Lithium President North America, and testimonials from two recent, local graduates employed in manufacturing. The participants, then, had an interval at three different activities: a tour of Rockwood Lithium’s manufacturing facility and laboratories, an engineering competition designed by NCSU Engineering House, showcase by the sponsoring companies and educational institutions including a scavenger hunt. The day concluded with a luncheon when the winners of the engineering competition received \$50 gift cards. Additionally, door prizes, six iPads and \$25 gift cards, were randomly awarded to those who completed the showcase scavenger hunt.

A scholarship program was added to this year's event. Scholarships valued at \$5,500 are available to high school seniors who attend the event and decide to major in a Science, Technology, Engineering or Math (STEM) discipline at a college or university for the 2015-2016 academic year. At the event, students were provided with an application and program information detailing the eligibility requirements and documentation needed to apply. A letter describing the event and the scholarship opportunity was sent to each student’s parents before the event.

The MIW event is one way in which recruitment into engineering and manufacturing can be fruitful. It is also an avenue for a successful workforce development pipeline in a region where unemployment has devastated the communities and wrought decades of dependence upon government aid for much of the population. The debate about workforce development has been transpiring for years, but for stakeholders, especially in the MIW region, questions still remain. Is there an issue with the talent of the current workforce, and if there is, what is the reason? What is the most efficient way to raise the proficiency level of existing workers, and what does training look like for jobs that are not yet available? The dynamics behind those answers are as fluid as the questions, themselves; However, research points to social investment, government policy, and public funding in providing opportunities for people to gain higher skills for employment.¹⁻⁵

The Current State of Workforce Development

Certainly, much thought and consideration has been invested in closing the skills gap and enhancing workforce development for the global market. In the United States alone, government policy has tried to influence the economy through employment programs and training acts since the mid-1900's¹. Undoubtedly, the lack of skills in today's market is vastly becoming a global epidemic.³⁻⁶

Some researchers, point to years of government programs enabling people to rely on social welfare systems instead of actively seeking opportunities to better themselves. "Welfare to workfare" is a term deemed by Kapitzke and Hay⁴ to express the strategy behind their Gateway Schools projects in Australia where students are able to gain practical skills from workplace experiences and industry interactions.

Other perspectives on workforce development discuss the incentives gap which includes the employer's inability to provide workers with the prospect of professional development, advancement, and equitable salaries. Gebauer⁵ proposes that workers in China have become more selective in choosing an employer who supports lifelong learning and advanced training. Companies that do not provide such incentives are not attracting the skilled labor force they need to be successful.

Moreover, additional scholars believe the lack of a skilled labor pool is really an interest gap caused by the limited experience in early years that prohibits prospective employees from making informed decisions about career paths.⁷ Morales⁸ believes that "poor preparedness and insufficient information about chosen careers are likely to result in disillusioned college students abandoning their STEM majors".

Innovation and Industry Engagement through Happenstance Events

No matter what the phenomenon is termed, the bottom line is this: the emphasis on STEM careers is necessary and the job market is ripe for the harvest. As indicated before, the variance in solutions for filling the gap is as wide spread as the ideology behind the gap; however, two commonalities have emerged in the examination of the literature, innovation and industry engagement.

Innovation is a characteristic that represents advancement and exclusiveness in the global market. Bozic and Dunlap⁹ express the idea that innovation is not just to be integrated into the curriculum; it should be the curriculum. The irony lies in the idea that engineering talent, the greatest contributor to innovation and chief advantage for the US over other countries, is retiring out of the workforce faster than fresh engineers are funneled back into the workforce.⁹ Atkinson and Mayo¹⁰ suggest the streamlining of courses in high school do not give students the freedom of choice which is actually stifling innovation, and in most high schools, engineering is not even an option. With the majority of STEM jobs being engineering positions, the prominence of engineering education should be on the forefront. Atkinson and Mayo¹⁰ state "one reason the education system has not produced the kinds and numbers of STEM graduates needed is that it has attempted to accomplish this task in isolation from industry".

Industry engagement is a concept that has grown in popularity among educators. Most schools do offer some support for students in the way of a career counseling and career fair events. Sadly, counseling sessions and typical career fairs last only a couple of hours and are held in settings that do not truly depict the nature of the work. Kim, Jang, Jung, Lee, Puig, and Lee⁶ call the knowledge gained at these types of events “planned happenstance skills”. Kim, et al.⁶ completed a study with 217 Korean undergraduate students using four measures to observe how happenstance skills related to effective decision making, satisfaction, and commitment when it came to choosing a career. They found that students who had a higher score on planned happenstance skills were more involved in their career outlooks which lead to greater certainty in choosing an appropriate and satisfying career.

Happenstance skills can be gained in many ways. Loera, Nakamoto, Youn Joo, and Rueda¹¹ confer the benefits of career and technical education as a way for students to experience an atmosphere similar to the actual working environment and build a mentoring relationship with the teacher as a model. “If teachers develop and expose students to a career-related curricula program, those students may be more likely to continue in their education and career preparation after high school and feel better prepared for their future”.¹¹ Furthermore, Holman² states “faculties are uniquely situated to encourage STEM students to engage in high-impact practices and also provide entry points for their participation in research and other hands-on experiences in their disciplines”.

It is clear that when students participate in more involved happenstance events prior to their college career, they are ready for the challenging experiences in problem based learning, research, and internships awaiting them at a college level and beyond. The literature points to engagement of industry as an ingredient in the recipe for success. Most research is focused on career planning and development for college students, but without early guidance, students may spend a considerable amount of time and money finding the right path for themselves. Gregson³ shows evidence of student learning through partnership with industry in the “Discover Science” program that allowed students to work alongside professionals in a bioengineering firm. “Student learning was engineered through collaborative processes which played an important role in developing student confidence in their ability to understand, solve problems and to function in a new and unfamiliar context. The experience provided the engagement which excited and motivated the students, their teachers as well as the student advisors”.³ The research presented thus far is what guided the culmination of a local happenstance event that truly focuses on both engineering and innovation.

Making It Work Case Study

The MIW model is an all-inclusive plan that embraces the idea of the three gap phenomenon: the skills gap, the incentives gap, and the interest gap. Designers of the MIW fair pooled resources from all stakeholders to develop an event that can fundamentally contribute to filling the holes of previous undertakings to workforce development. As seen in Figure 1, the primary emphasis and driving momentum is the interest gap.

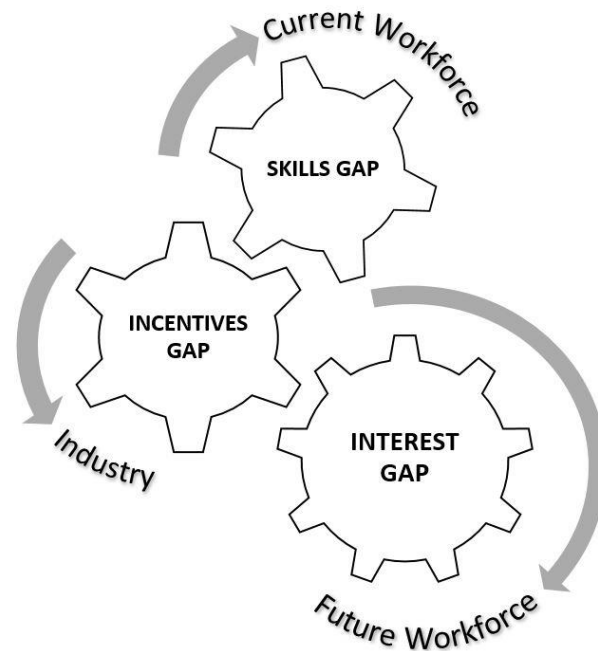


Figure 1. Making It Work Model showing the relationship of the gap phenomenon.

In the foothills of Western North Carolina, there was a presence of unity between, government entities, education boards, and the community that was founded by a willingness to work together and most recently, historic job loss and slow economic ascension. The rural area between Asheville and Charlotte has become a fertile crescent with the logistical infrastructure in place to support a variety of manufacturing processes and facilities. As the stakeholders discussed how to align the workforce to growing demand, one entity was missing from the table, industry. Indeed, the area was a reflection of the general population and global position on workforce development. As industry became more involved with local business advancement, it became clear that industrial entities should be the driving force with the other entities serving as navigational beacons for support. That awareness opened the door to MIW.

The PPG industry foundation was a key part in creating the MIW event. The plant manager from the PPG contacted the Industrial Extension Service at NC State University (NCSU) about how to partner on a foundation grant to be used locally. The grant required a university partner, and the plant manager was a graduate of NCSU. For him, it was a natural tendency to reach out to a familiar organization. As the planning unfolded, communication opened up through the network of government entities, education boards, and the community, specifically in Rutherford and Cleveland counties. In 2011, MIW was launched with an event date scheduled for fall 2012. The planning team consisted of plant managers and engineers from industry, Cleveland County Economic Development Partnership representatives, the Region C Workforce Development Board, K-14 educational institutions, and the Industrial Extension Service of NC State University. There were thirteen monetary sponsors for the first event; of the contributions, 92% came from local industry. The foundation's initial funding primed the pump that has now developed into a planned happenstance event that is enhanced each year. In fall 2014,

scholarships were introduced. The progression of the event has been remarkable, and it has gained publicity throughout the state. Participants who come to the event are chosen from an application selection process based on their career interest, class choices, and enthusiasm for STEM.

As the outcomes for the event became more streamlined, the stakeholders were able to pinpoint characteristics that provided the most benefit for participants. Figure 2 shows a visible connection between the characteristics of the MIW fair and the solutions found to be effective in filling the interest gap.

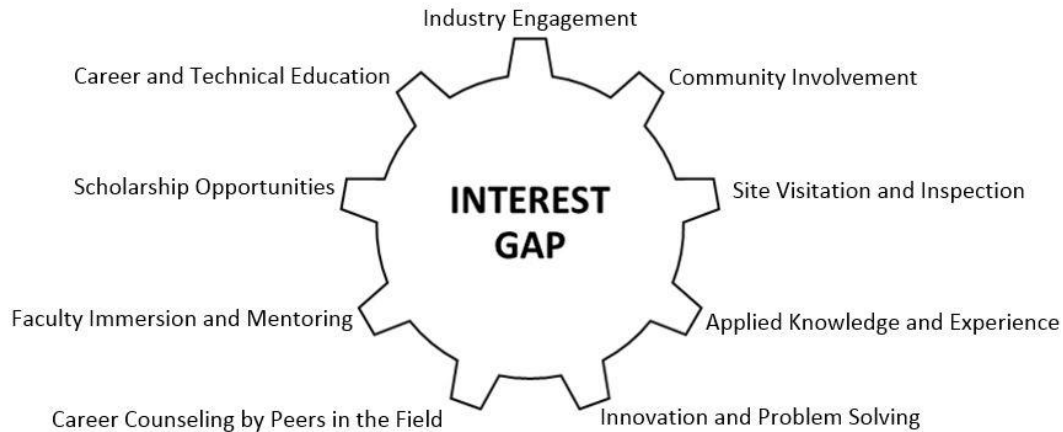


Figure 2. Making It Work bridging the interest gap characteristics.

Just as the teeth of one gear connect with teeth of another gear to generate movement, the common characteristics connect between the interest gap, incentives gap, and skills gap to make one dynamic system that contributes to overall success of the program. A greater amount of contact between gear teeth yields mechanical advantage and a more harmonic motion. The same is true of the MIW. The teeth of the MIW model are Industry Engagement, Community Involvement, Site Visitation and Inspection, Applied Knowledge and Experience, Innovation and Problem Solving, Career Counseling by Peers in the Field, Faculty Immersion and Mentoring, Scholarship Opportunities, and Career and Technical Education. MIW not only engages industry, but is driven by industry.

The planning team and exhibitors are by far the majority in decision making and design. Several community figureheads take part in the actual event day. Representatives from establishments such as the Economic Development Commission, NC Works, and the NC Workforce Development Boards are very helpful in serving as a moderator between industry and the workforce. On the day of the event, participants are able to see and experience being in a real industrial environment. They are able to take in the sights and smells. Wearing the personal protective equipment makes them feel like an employee. The organized tour gives them a tangible understanding of what it would be like each day on the job. Participants get to ask questions and interview employees from the Ph.D. researchers to the technicians and custodial staff. To help cultivate the learning experience, participants complete a design challenge. The

design challenge is presented by the College of Engineering at NCSU and carried out on the day of the event by the NCSU Science House and The Engineering Place. The challenge is a competition, and students do win prizes for the most innovative results. In addition, participants hear from recent graduates who are currently working in the industries represented. They are able to interact with the graduates in a round-table like discussion to receive career counseling. Participants are able to relate to these young graduates and express interest in the discussions.

So far, the participant's perspective has been shared, but the faculty and administrators who accompany the 200 participants each year have learned just as much from their experience. When gaining feedback from faculty, statements like "now I have a real example I can present in class" and "I understand better what to prepare my students for since I came to this event". Faculty and administrators gain skills to mentor their students beyond the day of the event. The industry sponsored scholarships were added to enrich and sustain the happenstance skills of the participants. Students who came to the MIW event have the opportunity to apply for one of several scholarships that will help them pay for education and training in a STEM career. Many of the MIW planning members, as well as, some faculty are also a part of the scholarship committee. The introduction of the scholarship funds for this year have helped create an additional network of communication with professional engineering institutes.

The final connection is with the career and technical education already present in the school systems and community college training programs. Participants are encouraged to gain hands-on skills and explore technical careers through these avenues especially while they are still in high school. MIW's focus is on shortening the interest gap, but as a bonus, relations with industry and between industries have strengthened. Figure 3 depicts some of the same characteristics that industrial partners reported to have helped them in finding solutions to their workforce needs. When assimilated, many of the characteristics are the same.



Figure 3. Making It Work bridging the incentives gap characteristics.

Other than introducing what expertise is necessary in engineering and manufacturing, the skills gap was not truly countered with this single event because the skills gap is specific to the current workforce. This event was a primer for the future workforce, but through analyzing the literature

and gathering other informal feedback, the resolutions were once again found to be common. Each cog is an influence on the skills gap. The more industry is engaged, the more teachers understand what industry actually needs from education; therefore, the skills gap gets smaller because the curriculum reflects industry needs. Again, the characteristics specific to the MIW are shown in Figure 4.



Figure 4. Making It Work bridging the skills gap characteristics.

In the event assessment surveys, students were asked to supply feedback in four general areas: 1) Exhibitors were informative and supplied adequate information about their organization, 2) The engineering competition was educational and fun, 3) This event helped me to understand more about career choices in engineering and manufacturing in the region, and 4) This event was a valuable tool for providing information, and I would recommend it to other students in the future. Overwhelmingly each of the categories had 96% to 100% satisfaction rates. Students made comments like “I really liked it. It gave me an idea of what an engineer really does”, “The exhibitors were friendly and provided excellent information on local manufacturing and engineering”, “Wide variety of factories”, “I understand more about the jobs I can get in engineering”, and “Being able to talk with workers who had gone straight to work from high school and received on-the-job training”.

The Future of Making It Work

Further research for future MIW events is ongoing. Increasing the follow up and mentoring role for participants is a topic of recent discussion. Current surveys include getting a better idea of the capacity it would take to include industry, two-year colleges, and universities to volunteer in assisting students with a career development plan. This plan could possibly take place as part of the scholarship application. Other ideas include internship programs in partnership with tech-prep grants and the NC Department of Commerce internship program. Internships would be a no cost contribution to the fair that would have lasting effects on the self-efficacy and decision making for all participants.

The MIW experience serves the student through a holistic approach for their success. The motivating force is indeed industry. Without the in-kind contributions, human resources, and monetary donations, this planned happenstance event would not be as successful as it has become and will continue to be in future years. Guidance is necessary for success. The MIW team will press forward in bridging the interest gap and contributing to minimizing the incentive and skills gap too. The definitive goal is also to share this working model with other areas and keep a steady stream of communication going, not just in Western NC, but across the nation.

References

- 1 Richards, C. and Herranz, J., Jr., Everybody WINS: Effectively involving business in workforce development. Jobs for the Future, Boston, MA, 2001.
- 2 Holman, D., Supporting stem student success, competitive advantages, and engagement in career development. *Career Planning & Adult Development Journal*, 29(2), 2013, 73-80.
- 3 Gregson, R., Bring Back the Wow: A Model for Engaging Students with Real Scientists Doing Real Science. *International Journal of Learning*, 17(12), 2001, 293-306.
- 4 Kapitzke, C., and Hay, S., School Education as Social and Economic Governance: Responsibilising Communities through Industry-School Engagement. *Educational Philosophy and Theory*, 43(10), 2011, 1103-1118.
- 5 Gebauer, J., Workforce engagement. *T+D*, 2006, 28-30.
- 6 Kim, B., Jang, S., Jung, S., Lee, B., Puig, A., and Lee, S., A moderated mediation model of planned happenstance skills, career engagement, career decision self-efficacy, and career decision certainty. *The Career Development Quarterly*, 62(1), 2014, 56-69.
- 7 Coulter-Kern, R., Coulter-Kern, P., Schenkel, A., Walker, D., and Fogle, K., Improving student's understanding of career decision-making through service learning. *College Student Journal*, 47(2), 2013, 306-311.
- 8 Morales, H., Ignite zeal for STEM learning. *Techniques: Connecting Education and Careers*, 85(3), 2010, 22-24.
- 9 Bozic, C., and Dunlap, D., The Role of Innovation Education in Student Learning, Economic Development, and University Engagement. *Journal of Technology Studies*, 39(2), 2013, 102-111.
- 10 Atkinson, R. and Mayo, M., Refueling the U.S. innovation economy: Fresh approaches to Science, Technology, Engineering and Mathematics (STEM) education. Information Technology and Innovation Foundation. 2010.
- 11 Loera, G., Nakamoto, J., Youn Joo, O., and Rueda, R., Factors that Promote Motivation and Academic Engagement in a Career Technical Education Context. *Career & Technical Education Research*, 38(3), 2013, 173-190.

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