Meeting Workforce Demand through Industrial Partnership: A Case in Louisiana

Dr. Nabin Sapkota, Northwestern State University of Louisiana

Nabin Sapkota is an Assistant Professor in the Department of Engineering Technology at Northwestern State University. He received a B. E. degree in Production/Industrial Engineering from the Regional Engineering College, Tiruchirappalli, Tamilnadu, India and a M.S. and Ph.D. in Industrial Engineering from the University of Central Florida (Orlando, FL, USA). He has a diverse expertise in the areas of Operations Research, Simulation, Quality Engineering, and Nonlinear Dynamical Systems. He previously worked on projects related to dynamic routing of emergency vehicles, modeling consumer sensitivity for product design and perceived usability, dynamic control charts in statistical process control, application of evolving self-organizing maps, etc. His current research interests include prediction of nonlinear chaotic system involving human emotion in social media, difference in muscular exertion in different ethnic workers in automobile industries, simulation, and advanced application of statistical techniques. Dr. Sapkota is a Certified Six Sigma Green Belt.

Ms. Laurie D. Morrow, Central Louisiana Technical Community College

LAURIE MORROW Laurie Morrow currently serves as the campus administrator for the Central Louisiana Technical Community College, Natchitoches Campus, Natchitoches, LA. Her career began as an accounting instructor evolving into student services and finally administration. Areas of expertise include program accreditation, curriculum development, and workforce development through customized training. Ms. Morrow has been and continues to be instrumental in the development and implementation of the Advanced Manufacturing Technician Program of Louisiana.

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A case in Louisiana

Abstract

Governmental and nongovernmental agencies nationwide anticipate an ever-increasing workforce demand due to the inevitable retiring of our current "baby boomer" population. In the past, several initiatives to meet workforce demand through cooperative educational model were short lived. The reasons for discontinuation of such programs can be attributed to either lack of planning or not enough success compared to the anticipated level of success from the program.

In this paper, authors explain how a Modified Apprenticeship Program (MAP) tailored to meet the needs of local industries can be sustained without expending a large amount of resources. The example for this case is 'Advanced Manufacturing Technician' (AMT). Several years ago Northwestern State University (NSU) of Louisiana partnered with Central Louisiana Technical Community College (CLTCC) and collaborated with local and regional manufacturers to offer a two-year Advanced Manufacturing Technician (AMT) degree program. This program is not a typical college degree program. Modeled after Toyota Maintenance System, this program provides the opportunity for a work/study environment to the students where they are honed to become a well-versed technician with knowledge and skills in core manufacturing practices (safety, 5S, lean manufacturing, problem-solving and machine reliability) as well as six essential professional behaviors (attendance, initiative, diligence, interpersonal relations, communication, and teamwork).

In this paper, authors who have been with the program since its inception explain the process of bringing local and regional industries on board as to achieve the common objective of meeting technical workforce demand in the region and in the country. The paper explains the process to initiate such programs and highlights potential issues that can arise while launching a successful program. Industrial partners' testimonials, interactions in addition to authors' own experience in this regard have been used as the basis for this study's findings.

Introduction

According to NACE's Job Outlook 2018 survey of employers nationwide, employers are looking for qualities that are not specific to their field of study [1]. According to the report, problem-solving skills (82.9%), ability to work in a team (82.9%), written communication skills (80.3%), leadership (72.6%), and strong work ethics (68.4%), were the top five attributes out of a total of twenty attributes they want to see on their graduates resume. These attributes are general in nature and not very specific to any field of study. Analytical/quantitative skill, initiatives, and verbal communication skills were tied at 67.5%. In addition, the top two attributes that have the highest influence factors among 12 were 'Has completed an internship with your organization (4.6/5)' and 'Has internship experience in your industry'of attributes (4.4/5). Attribute 'Major' (3.8/5) was the third, 3.0 or above GPA (3.4/5) was the third, and the last attribute 'Has studied abroad' (2.2/5) in that survey. Essentially, this survey shows that the qualities and attributes industries want in their recruits are not high GPA, or bi or multilingual, or even the school they have attended.

It appears that apprenticeship is the answer to the employers' expectation in college graduates (both associates and bachelors). The US Department of Labor states apprenticeship as "a proven approach for preparing workers for jobs while meeting the needs of business for a highly-skilled workforce" [2]. According to its website for apprenticeship https://www.dol.gov/apprenticeship/ over 440,000 apprenticeships have been hired since January 2017 in the US (accessed on 2/3/2019) [3]. According to the DoL, there are several sectors where apprenticeship is working with successful results, such as, advanced manufacturing, construction, energy, finance and business, healthcare, hospitality, information technology, telecommunication, transportation etc. The department has also added a dedicated website https://www.apprenticeship.gov/ to bring employers, job seekers, and educators to a common platform where employers can post their apprenticeship jobs, prospective employees can explore their different career pathways through apprenticeship programs and educators can learn about these needs and accordingly modify or build curricula to include training [3].

Apprenticeship programs help both employers and employees. Employers get a highly skilled industry-ready workforce with structured and systematic training that help employers to achieve high employee retention, safer work environment leading to reduced workers compensation claims, and enhanced productivity due to knowledge gained during work-study learning. Employees can benefit from the real-life experience, increased knowledge and skills, reduced financial burden, and increased confidence. However, there are some serious disadvantages to the traditional apprenticeship program. Göggel and Zwick [4] report that apprentices face wage losses from occupation change whereas their counterpart (those with a college degree) actually benefit from changing jobs within the industry in terms of increased wages and benefits. Further, from employees' perspective apprenticeship may limit their career pathways and will be forced to get stuck in that job for life; transitioning to another career is not easy. With the rapidly changing technological advancement and their effect in needs of the industries make traditional apprenticeship program unattractive and in some cases, even undesirable as some of the jobs are sure to vanish within an individual's career. Also, a lack of clear understanding from business and industry partners coupled with a poorly structured training and mentoring program, have lead to many work-study (semi-apprenticeship) programs demise. From industry perspective, an apprentice program is a resource demanding endeavor and many times the industry will fall

victim to ‘poaching’ by industries with similar occupations of their trained and skilled workforce. Industry has also noted that an apprenticehip program can create an ease of access for trained workers to find similar jobs and the ability to migrate across cities or states.

In recent times, manufacturing, construction and the military are the three sectors dominating in the field of apprenticeship. In this paper, authors use manufacturing as the field of choice to explain the modern apprenticeship model that can mitigate several of the concerns of the prospective employees. According to the Department of Education’s Integrated Postsecondary Data Systems, there were approximately 35,000 2-year ET degrees awarded in 2014 by 1,192 academic institutions both private and public institutions[3]. It is obvious that ET is slowly but steadily making its footprint in the workforce market. Department of Labor [5] reports approximately 200,000 electrical, electronics, and industrial technician were employed in the US in 2016

Method

This paper uses a case-study approach with the example of the unique ‘earn and learn’ program, Advanced Manufacturing Technician (AMT) in Louisiana. Authors were directly involved with the AMT program before its inception and through the program’s development, approval process, and delivery methods. Also of note, the authors’ participation in various relevant conferences such as the annual conference by America Society for Engineering Education (ASEE) and Conference on Industry and Education Collaboration (CEIC), provided guidance for them to propose the framework of a modified apprenticeship program (MAP). This program does not limit career pathways for student/worker and meets or exceeds attributes sought out by industries in today’s skilled worker.

At present, the authors are directly involved in the daily operation of the program. For the past two and one half years, authors have conducted regular meetings with the industrial partners to discuss various concerns, issues, and experiences regarding the AMT program. Authors have also received a monthly evaluation from the students’ industrial mentors. (see Fig. 1). Furthermore, authors periodically, request that students provide program feedback regarding positive experiences and as well as opportunities for improvements. Testimonials provided by the students, interactions with industrial partners, as well as feedback from industrial mentors are used in this study as primary data to arrive at findings and conclusions.

ADVANCED MANUFACTURING TECHNICIAN

Work-Based Learning (WBL)
***Instructional Plan and Competency Evaluation:* Form A**

Student: _____

Industry Site: _____

Course: _____

Date of Evaluation: _____

SKILLS RATING SCALE	
5- Skilled	Can perform independently with no additional training provided.
4- Moderately Skilled	Has performed independently during training program, limited additional training may be required.
3- Limited Practice	Has practiced during training program, additional training is required for development.
2- Exposure Only	General information provided with no practice time, close supervision and additional training required.
1- No Exposure	No information or practice time during training program, complete training required.
0- Unsatisfactory	Performance below expectation.

Competency Requirements (Minimum Level Required)	Skill Level					
	5	**4**	**3**	**2**	**1**	**0**
1. COMPLETED AND UNDERSTANDS COMPANY SAFETY POLICY						
2. ATTENDANCE						
3. DEMONSTRATION OF WORK ETHICS AND VALUES						
4. INTERACTION WITH COMPANY PERSONNEL (TEAM PLAYER)						
5. APPEARANCE (APPROPRIATE ATTIRE FOR WORK, PPE, ETC)						
6. OTHER: (PLEASE SPECIFY)						
7.						
8.						
9.						
10.						
11.						
12.						
13.						
14.						
15.						

Evaluator Signature: _____ Date: _____

Trainee Signature: _____ Date: _____

Figure 1 Example of an evaluation form for industrial mentors to evaluate students

Proposed Framework for Modified Apprenticeship Program (MAP)

The basic framework of the proposed MAP is shown in Fig. 2. This framework combines the traditional apprenticeship program shown in Fig. 3 with a conventional college degree program augmented with industry desired behaviors (IDB) and industry specific exercises (ISE).

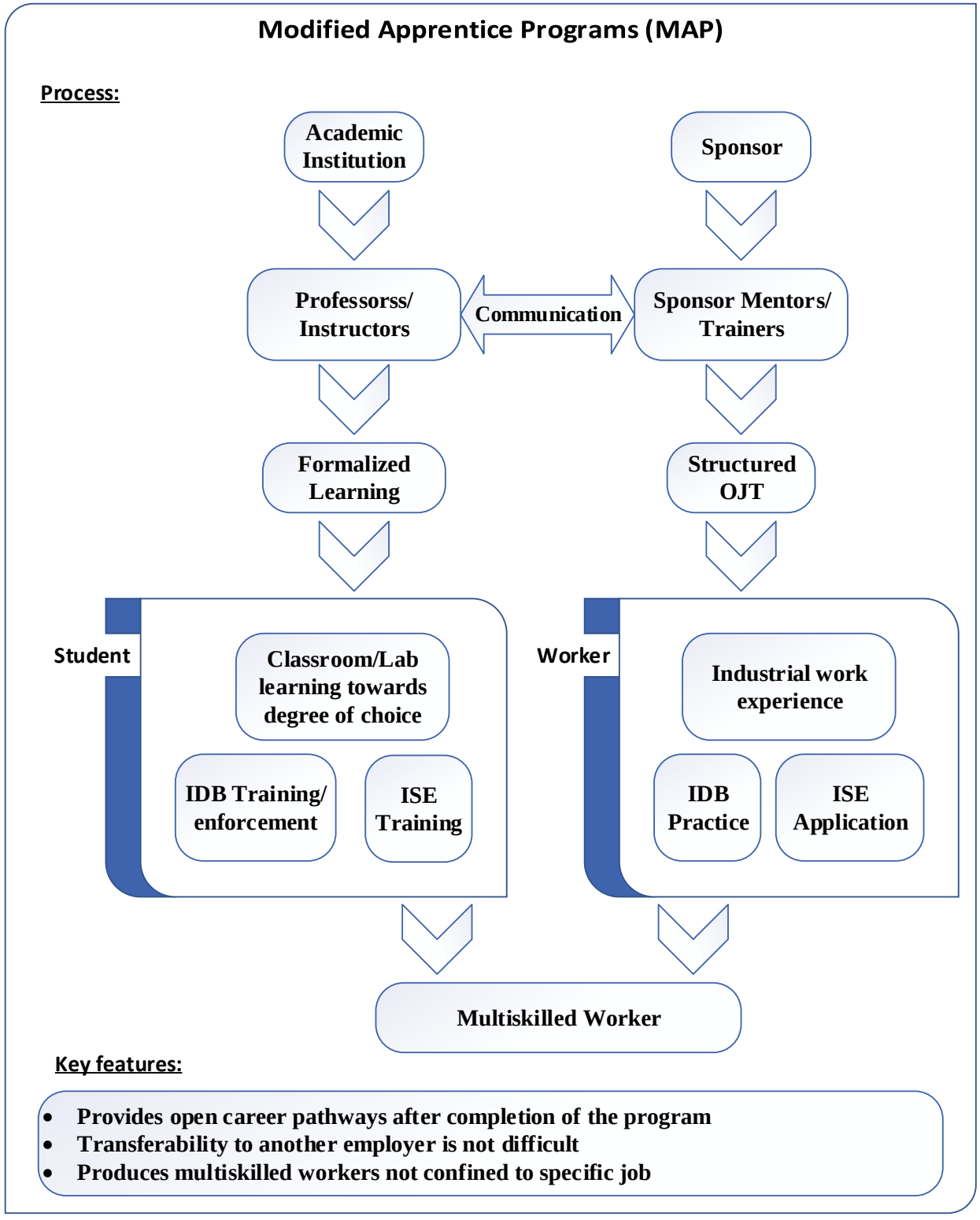

Figure 2. Framework proposed MAP model

Key requirements for the proposed MAPs

In order for this program to be successful, the following requirements must be met for its intended benefits to students, industries, academic institutions and to the community it serves.

1. **Sponsors:** They are the consortium of industries willing to work together with the common goal of producing highly skilled employees through structured training, mentoring, and on the job training needed to bolster the academic knowledge students gain through the participating academic institutions. It is recommended to create an organization to oversee the program and provide leadership in developing processes for continuity of the program. It is also possible to involve local or regional community partners or organizations in a mediating role to make the process more effective and efficient. Perhaps the most important feature of a strong MAP is the mentoring within the company. Sponsors should develop mentors and trainers to facilitate and strengthen the apprenticeship program within their organization. Employers should select mentor-trainee pairs that are a good fit and understand the program. They should also work with the local academic institution to develop structured training process for student workers while they are working in their organization.
2. **Academic Institution:** The primary job of the academic institution is to provide a non-conventional classroom/lab environment that mimics the real-world work environment as closely as possible. Second, they have to develop customized industry-specific exercises tailored to meet their general requirements providing students with the most exposure to the respective industry. Finally, the academic institituion is responsible for incorporating and modeling the desired personal behaviors in each course.
3. **Identification of Industry Specific Exercises (ISE):** These exercises are the activities supported by learning materials customized to a specific industry type. Academic institutions first teach the relevant concepts to the students in a simulated environment and then students are required to reproduce their activities in a real-world scenario. Effective structured communication between academic mentors and industry mentors should occur on regular basis (biweekly or monthly) regarding the students progress, current concepts being taught, upcoming students activities, and responsibilities with respect to deliverables from those activities.
4. **Industry Desired Behaviors (IDB):** Strong examples of these behaviors are diligence, initiative, leadership skills, teamwork, communication skills (both oral and written) problem-solving skills, work ethic, flexibility/adaptability, interpersonal skills, and punctuality. Collectively, the sponsors and the academic institutions should model and assess these skills on daily basis correcting undesired behaviors at the earliest possible opportunity. Sponsors should conduct a holistic evaluation of their student workers at least on a monthly basis using a standardized form (an example shown in Fig. 1) providing those results to the academic institution. Students unable meet established expectations and criteria or those frequent violators should be dealt with according to the bylaws of sponsors' consortium.

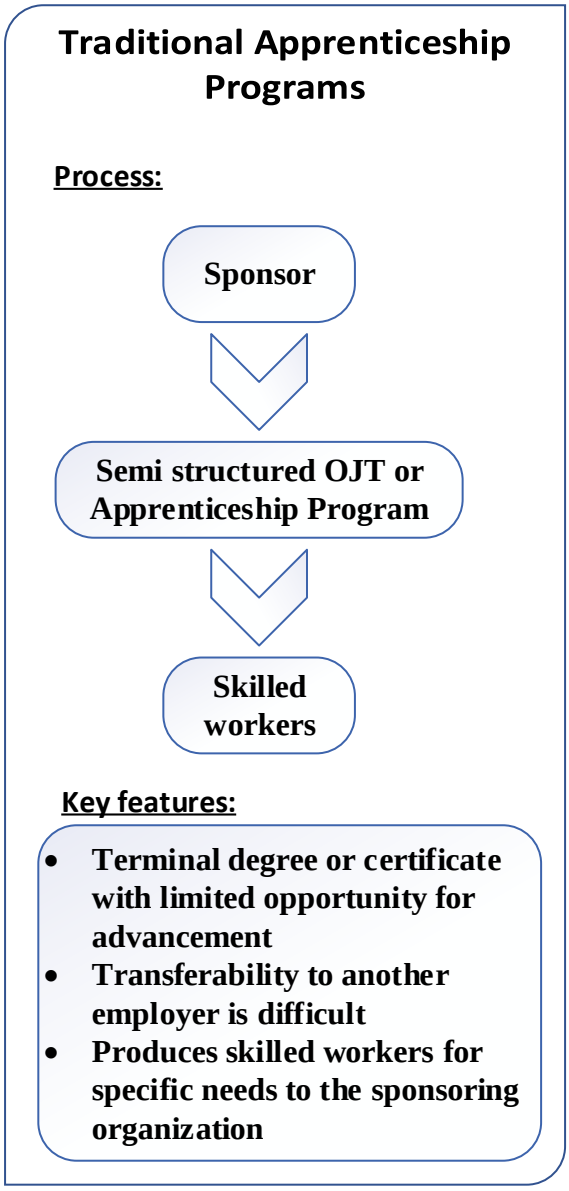

Figure 3. Schematic of Traditional Apprentice Model

5. **Career pathways and growth:** One of the concerns of traditional apprenticeship programs is that the apprentice has limited oneself to the trade and is stuck in that organization forever without hope of career advancement or growth. It is strongly recommended that there should be clear and well-defined career pathways and growth possibilities for the students. A career pathway is simply a combination of high-quality education, training, and other services that align with educational and industry partners. A career pathway can include multiple entry and exit points to facilitate individuals to build their skills as they progress through their curriculum and training. Career pathways also enable lifelong learning by allowing participants to gain entry to and advance through education and training programs leading to stackable credentials. These career pathways can be implemented by developing and executing articulation agreements between the educational institutions thus avoiding any ambiguity.

6. **Continuous Improvement:** The term continuous improvement is used across industries to describe a process or approach to problem solving that represents an ongoing effort to improve outcomes. On a regular basis, sponsors, community partners, and any academic institutions involved should reflect and learn from experience while testing and refining strategies to produce imporved results. The MAP team must constantly be alert and aware of areas of needing improvement and take necessary action based on observational and measured data, and measured efficacy of the implemented plans.

A case in Louisiana

According to the Federation for Advanced Manufacturing Education (FAME) both the AMT Program and the FAME organization had their origins at Toyota's North American Production Support Center (NAPSC) in Georgetown, Kentucky [6]. The AMT Program was an outgrowth of a continuing education program that Toyota had been developing for over 20 years, Starting fall 2017, to develop and sustain a pipeline of multi-skilled technicians in the manufacturing industries in the state, and as a collaborative effort between Northwestern State University of Louisiana (NSU) and Central Louisiana Technical Community College (CLTCC), a 2-year Advanced Manufacturing Technician (AMT) program began accepting students. After successful completion of the program, AMT students obtain an Associate of Science in Engineering Technology (with a concentration in Advanced Manufacturing) from the 4-year university (Northwestern State University of Louisiana, NSU) and a certificate in technical education from the technical college (Central Louisiana Technical Community College, CLTCC) and an Advanced Manufacturing Technician certificate from GeauxFAME, their own FAME chapter [7]. Currently, there are six industries from the central Louisiana region that comprise the sponsors' consortium. AMT program's detail curriculum layout and the specific ABET ETAC student outcomes mapping for Associate of Science in Engineering Technology can be found in in [8].

AMT Program Overview

Student selection

Prospective students apply for the program and are admitted each fall semester. Upon admission to the academic institution, the consortium of sponsors interviews and extends offers to the accepted program candidates. Upon hire, students are required to attend the orientation program of their respective employer and any other additional training required. Generally, the students start working full time for the sponsors in the summer before they begin coursework in the fall.

Regular semester

Students attend classes two days per week for at least 8 hours daily. The length of the school day is intended to mimic a full 8-hour shift in the workplace. Students will work the remainder of the week for a minimum of 24 hours. The students sometimes perceive the schedule as rigorous and if they do manage their time efficiently.

A typical day

Students will arrive for an 8:00 am class by 7:30-7:45 am in attire appropriate for the workforce. In addition students understand they are required to notify their instructors of impending absence

or tardiness in a timely manner. These are exercises that are directly intended to prepare the student to in becoming a model employee. Daily, students participate in a five-minute "safety circle" before the morning classes and again before afternoon classes. The safety circle is facilitated by a student who will lead a discussion on a safety topic of their choice. Classmates and instructors are encouraged to add comments and provide feedback regarding the leaders choice of topic, his/her delivery, and body language. At the conclusion of the safety circle, the speaker self-evaluates on his/her delivery based on best communication practices. At least two other students provide their own evaluation of the speaker to the group. All students will participate in leading the safety circle on a rotational basis.

If it is a work day for the students, they follow the schedule provided by their respective employer. The expectation of students is to arrive and report to the assigned mentor/trainer on time and carry out the assigned tasks for the day. Students are encouraged to seek clarifications on anything related to their assigned task from a supervisor, mentor, or the trainer. Generally, mentor counsels with the student to inquire about his/her progress, experience, concerns or any other issues the student may have at that time. At the end of each month, the mentor completes the student's evaluation and submits to the assigned school instructor.

Manufacturing specific courses

There are five manufacturing courses for the AMT program.

Table 1. Industry-specific courses for the AMT program

Manufacturing industry specific courses	Class lecture	Presentation		Replicated at the sponsor	Team-based assessment
		School	Work		
Safety culture	✓	✓	✓	✓	×
5S (Workplace organization)	✓	✓	✓	✓	×
Lean Manufacturing	✓	✓	×	×	×
Problem Solving	✓	✓	✓	✓	✓
Machine Reliability	✓	✓	✓	✓	✓

Manufacturing specific courses are offered one course per semester in the order shown in Table 1. The program includes two summer semesters. These courses include several activities that influence students' behaviors, attitude, promote diligence and initiative, interpersonal skills, teamwork, and both oral and written communication.

Performance matrix

There are several performance indicators for this program. The program is currently in its second year and no students have graduated from the program. However, a performance matrix based on the statistics of the second cohort of students of this program has been summarized in Table 2.

Table 2. Performance matrix for the program as of February 2019

Performance Indicator	Current	Desired
Enrollment	8	15-20
Num. of Industry Sponsor	6	8-10
Student retention	87.5%	100%
Student placement*	N/A	100%
Student positive performance evaluation by the sponsor	87.5%	100%

*Based on the second cohort only; first cohort of students will graduate in summer 2019.

Potential Challenges

As with any new initiative there are challenges. In spite of issues and obstacles the authors still maintain this is the best model to develop our next generation workforce. Below are a few prominent challenges authors have encountered with this program; the list is not intended to be all-inclusive:

- Educating the public with information about the program has been especially challenging. Parents, educators, and potential students have been slow to embrace the program for sheer lack of understanding. In addition, these stakeholders still cling to the old stigma of community college being second-class.
- Enlisting and involving more industry sponsors has also proven to be difficult. It seems that many employers are taking the stance of waiting to see the outcome. We are confident our first group of graduates will prove the program worthy.
- The AMT program is designed to be "owned" by the industry partners. Instilling this ownership requires a complete shift of mindset resulting in a culture change. Industry partners must be trained to take the lead in governing this program.
- Identifying young adults ready and willing to commit to the rigorous work/school schedule is perhaps the greatest challenge. This schedule does not allow for traditional college life. The student must be fully prepared to commit to work and school with little time for outside activities.

Discussion

Any MAP endeavor similar to the one discussed here can be made more effective by aligning local high school curriculum to support students' career paths. Universities should review their requirements of core courses so that students can take more courses relevant to their technical field. A very strong structured mentoring and training program must be established with wholehearted commitment in the sponsoring organizations. Students in these programs are not considered full-time employees therefore; their wages and benefits should be appropriately considered. A daily reinforcement of desired professional behaviors and attitudes in students should always be viewed as one of the tasks of instructors and mentors in academic institutions and at the sponsors' locations.

Conclusion

The feedback of the students' performance with regard to their work and conduct in the workplace has been very positive. Sponsors' participation and the level of commitment to this program has been very promising. Comments from the students about the program have been very motivating and as educators involved in this program, authors believe that programs like this will be a way of meeting industry expectations in their workforce in coming years and decades.

References

[1] NACE. (2018). Job Outlook 2018: The Key Attributes Employers Seek on Students' Resume.

[2] Available: https://www.dol.gov/apprenticeship/toolkit/toolkitfaq.htm#2a (definition of apprenticeship)

[3] Available: https://www.apprenticeship.gov/

[4] K. Göggel &, T. Zwick, "Heterogeneous wage effects of apprenticeship training", The *Scandinavian Journal of Economics*, vol. 114(3), pp. 756-779, 2012.

[5] Department of Labor Statistics. Available: (https://data.bls.gov/projections/occupationProj, accessed on 2/01/2019).

[6] Federation for Advanced Manufacturing Education and the Advanced Manufacturing Technician Program. Available: (http://fame-usa.com/about/, accessed on 2/03/2019).

[7] Available: (https://nca-la.com/workforce-ready/amt/, accessed on 2/01/2019).

[8] Ahmad A., Wolff, M. (2018). Development of a Multiskilled Craftsman Program through Collaboration between Industry, Technical Community College and 4-year University. American Society of Engineering Education (ASEE) Annual Meeting.