BOARD #121: How Research Based Partnerships Create Meaningful Workforce Development Curriculum Work In Progress

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Abstract

This research strives to identify and address needs of industry by partnering with companies and creating worker friendly courses directly focused on the subject matter that they see as critical for future growth. As part of an NSF funded grant for advanced manufacturing at West Virginia University, a study on training and educational needs of industry in the state of West Virginia has been conducted, with efforts beginning to address those needs with specific partner input. The project is entering its fourth year with a workforce development course currently underway that is specific to the research findings.

First, the training and educational opportunities within the state were evaluated. This provided a snapshot of training opportunities for anyone, particularly young people, interested in entering the manufacturing industry. Later a survey was conducted under an IRB that canvased industries in the state. The survey sought to identify specific training deficiencies important to industry. They were asked about what micro-credentials they value, and what training gaps they would like to address. From that information a first course was created specifically targeted to the working population based on partner feedback. The course is online and asynchronous, with a series of modules that include learning materials such as text, slides, and videos. Since this is a funded project, the course is offered at no cost to the participants. The first course is in project management, as that subject was seen as one of the most in need of addressing by the partners, with the first cohort currently enrolled the course. Once the first students have completed the initial offering, there are plans to expand it to more partners and add additional requested courses. This work in progress describes the research based work done thus far and how new and improved offerings will be created with industry partners.

Introduction

As part of an NSF funded grant for advanced manufacturing at West Virginia University, a study of workforce preparedness in that topic was conducted in the state of West Virginia. The workforce development component of this research was conducted as a month of summer work per year for one researcher. As industry moves to more advanced, interconnected, and automated manufacturing, workers who can operate proficiently in the new environments will be required. This work in progress seeks to identify gaps between the training and education available to workers and the needs of the future of industry. The first research-based educational opportunity with specific partner input has been created. The first cohort of learners is taking the course in early 2025.

Background

As industry moves toward advanced manufacturing there is need for workers to be able to operate in an ever increasingly complex environment. Companies are implementing or plan to implement such technologies as machine-to-machine communication, cloud computing, and robotics. [1], [2] Many industry professionals are concerned that training may not keep up with

demands. [4] Workers will have to learn new skills in order to be employable in future environments. [5] Covid restrictions changed the nature of work, especially in the increase in remote work, in ways still being felt in industry. [3]

Methodology

Opportunities for training and education in advanced manufacturing for current and future workforce participants were researched. This involved seeking what training and education was available within the state for anyone interested in entering the manufacturing workforce. While anyone could be a potential new workforce participant, the typical new participant would be a recent high school graduate who is interested in entering the workforce and not going to a 4-year college or university. Most of this work involved searching web sites and interviewing workforce development officials in state government and university industry outreach specialists.

The next phase of the research was to determine which of the trainings and educational opportunities available were considered of the greatest value to industry. Information was also sought on what they considered to be missing from current offerings. This was done with an IRB approved survey of specific industry partners. When questioning partners the research centered on new workers and on those who were at or near promotion on the factory floor such as shift leads or foremen. The list of questions appears in Appendix A

Based on partner feedback, the most universally identified gap was in project management. Industry partners advised that this topic is not well covered in workforce training, and experience was missing for many current workers. So an online course in project management was created and made available to industry partners.

Results and Discussion

Phase 1 was to identify training and educational opportunities available to residents only within the state in order to keep within the scope of the research. It was found that there is little to no standardization or common understanding of what credentials might mean. Terms such as Digital Badging, Micro-credentials, Certification, and Area of Emphasis are used interchangeably, and the same term used in different places might mean very different things. For example these three offerings end with a "Certificate": California State University offers a 3-credit course in Advanced Manufacturing Engineering; Purdue offers a Smart Manufacturing Enterprise certificate consisting of five courses; and MIT offers a professional program in Industry 4.0 that requires nine months of course work.

The current pipeline of workers with training in manufacturing is limited in our state. High school graduates generally go either to college or direct to the workforce with no manufacturing training at all. Most training that is available centers around front line workers and tends to be task focused such as fork lift or welding. Some product related certifications are available such as those provided by Microsoft, Autodesk, or Mathworks. Some societies also offer online certifications. Some workers can get training at a state Advanced Manufacturing Technology Center, which is mostly CNC machining training. Some societies such as National Council for Advanced Manufacturing and Society of Manufacturing Engineers offer training.

A few colleges and universities in the state offer associate degrees in advanced manufacturing. Several others offer two and four year degrees in engineering technology. For front line workers a good option is to join a company-based training offered by a few specific large manufacturers in the state. In those cases the company pays for training that they want to provide to a captive audience of trainees, thus creating their own pipeline. A few other offerings from governments or trade associations are available, with credentials ranging from awards to associate degrees.

Phase 2 was a series of surveys conducted by online interviews lasting about 20 minutes. The questions appear in Appendix A. For the purposes of this work, selection of companies was limited to manufacturers in or bordering the state. Preferred companies for interviews were mid-sized manufacturers large enough to employ engineers. Large multinational companies were not included because they already have exclusive and specific training programs in place. The participating companies manufacture a wide range of products including machinery and equipment, beverages, aircraft components, and retail products. Some are state of the art in their industries while others have older processes.

With some exceptions, the typical participating company has only one facility and employs around 300 people. The number of engineers with a bachelor's degree or higher varies between the companies from 1 to 20, with most of the rest of the workforce having high school diplomas and some with additional training. All of the manufacturers consider finding skilled workers to be most challenging. They all do some form of shadowing training for new hires, pairing them with experienced workers who show them how to do the work. When asked about desired skill sets, some want specific industry skills, but are most looking for team players with ability to learn, problem solve, and have critical thinking skills. They expressed that such "professional" skills are hard to teach, while job specific skills can be taught.

None could name any credentials that they view as meeting their current training needs. Some like to see some job specific skills on the resumes such as forklift operations, MS Office Suite, and CAD. Some would like to see applicants with very job specific training related to their exact processes such as food safety. In those cases they train new hires themselves or send them to third party training. Nearly all participants anticipate growth in the next 5-10 years. They expect to increase product offerings, product lines, and employees. They expect more growth due to markets increasing and in at least one case some onshoring of manufacturing. Most expect to see more automation and robotics. They expect to hire more skilled laborers and want employees with critical thinking skills who can problem solve.

The participants generally agree that new hires are short on basic skills needed in the workplace. All of them noted that finding skilled labor is a major obstacle to successful future growth. Some skills that are lacking are math and arithmetic and computer skills such as MS Suite and file organization. Other desired skills included the ability to interact with customers and handle projects. Participants were asked if they could design a training program what they would want to teach. Some responses were job specific, and most want them to have more and better understanding in areas such as MS Suite, CNC, computer literacy, and safety. Almost all had some form of professional skill development in their desired training. They want applicants who can learn how to learn, problem solve, understand the cost of waste and inefficiencies, work in

groups, and have high standards. A common theme for them was project management, especially for those in an under-served category of being near to or recently advanced into a leadership position.

Phase 3 consisted of developing an online, self-paced course in project management. While not an "advanced manufacturing" skill, it was the most requested across industries. The course was created in Google Classroom using open source materials for maximum accessibility. Since the instructor was paid from grant funding, the course is offered at no cost to participants. It consists of six modules requiring about 1-2 hours each, for a total of about 10 hours of training. The scope of the course is not to produce a fully trained project management professional, but to provide some guidance in fundamentals on the subject.

The course was offered exclusively to one industry partner first, and a few other individuals who expressed an interest in the topic. Only about 20% of the learners from that partner completed one of the six modules, and none completed more that one module. Although specifically requested by the industry partner, none of the learners from that partner participated in a meaningful way. The entire course was completed by one other person who provided this feedback: "I found the course to be well-structured and easy to understand, primarily due to the instructor's effective summaries of the chapter content. The instructor's summaries helped the me grasp the main ideas and key details within each chapter."

Conclusions and future work

This work in progress provides a specific service based on research that identified gaps in workforce training. The state is lacking in workforce training opportunities. Industry was uninterested in badges, certifications, or other credentials. They are more interested in skills and abilities, and were able to identify several that they see as most needed. The project management course was created to begin to fill that gap, with more offerings planned in the future. Learner efficacy is a major problem. More needs to be done to get more of those enrolled to complete the course. One way to address this in future offerings will be to charge a nominal fee to learners so that the course has a greater perception of value.

Other courses could offer training the math and problem solving, computer skills, and customer interaction skills that industry wishes to cultivate. It may seem that these skills are not those directly related to advanced manufacturing. On the contrary, these skills are the kinds of flexible life-long learning skills that will serve workers no matter what industry changes are ahead.

References

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Appendix A - Interview and survey questions for industry partners

Company information

- Company name, your name and position
- What business sectors does your company serve
- How many state facilities does your company have
- Approximately how many employees does your company have worldwide, nationwide, in the state
- How do you see your products, processes, or technologies changing or evolving in the next 5-10 years

Current and future employees

- How many engineers do you employ who have a bachelor's degree or higher
- How about technicians, machine operators, anything from HS diploma up to a bachelor's
- Do you expect those numbers to change in the next 3 years, and by how many
    - What is a major drive that will help to achieve that goal
    - What is a major obstacle in achieving that goal
- For new hires, what are your expectations of skills sets
- What training credentials do you consider as meeting those expectations
- How do you train them after onboarding
- What pre-hire training that they come with now do you find well done and worth hiring on
- What is training is missing or underdeveloped in new hires
- If you could modify how they are trained before they are hired, what would you change

Future needs

- What new skills do you expect that employees will need in order to meet your future needs
- What credentials will you desire new hires to have before being considered
- How will you know that applicants have the skills that you want
- If you could design a whole new training program new hires at any level to have 3-5 years from now, who would you include in it, and what would you want them to learn?