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Engagement in Practice: Bridging the Gap between Industry, Universities, and K-12 Outreach

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Lisa works with employers, schools, students, and community stakeholders to scale up and sustain critical programs around careers in all sectors while emphasizing the professional and technical skills necessary to succeed in the workforce. Lisa's passion is working to build our future workforce by providing foundational skills and ensuring everyone has the information required to be successful.

Lisa is the Education Workforce Program Manager for Purdue Polytechnic's Indiana Next Generation Manufacturing Competitiveness Center (IN-MaC), as a program manager and is the owner of T3 Workforce Development and Process Improvement. She has been an adjunct professor with Purdue University, teaching Organizational Leadership (OLS) and Supervision and Technology Leadership and Innovation (TLI) since 2009. She has been teaching and training since 1992. Lisa has 35 years of experience in workforce development and education.

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Abstract

Workforce development has become a central focus in the United States as we move toward manufacturing products locally and the advancement and accessibility of Artificial Intelligence (AI) technologies that will fundamentally alter the future of work. However, there exists a disconnect between industry, institutes of higher education, and K-12 formal and informal education that can cause all entities to feel frustrated by the lack of progress toward building a future-ready workforce despite good intentions. Many existing programs across entities are attempting to address the needs of a future workforce, but often these programs act in isolation and do not capitalize on potential synergies. For example, potential industry partners may not be aware of existing educational programming in K-12 and/or institutes of higher education and how to meaningfully engage with those programs to influence their direction and support career awareness. Similarly, educational entities may not be able to keep up with the evolving needs of industry and future jobs, while each may offer their own training and upskilling programs without benefit of collaboration.

This paper captures the results of a workshop facilitated by faculty and staff from two universities, Georgia Institute of Technology and Purdue University, at a Digital Manufacturing conference focused on industry leaders. The workshop provided guidance and information about existing educational initiatives and the opportunities for community and industry engagement, while also fielding and summarizing input from industry leaders regarding their challenges around workforce development and community engagement. Discussions and key findings from this workshop emphasized the importance of aligning academic and industry expectations while enhancing recruitment and retention through inclusive strategies. Leadership development and experiential learning were also identified as key focus areas for workforce development. These findings reveal opportunities for building collaborative ecosystems that bridge education, industry, and communities.

Introduction

There is currently a workforce shortage across the country. According to Ferguson and Hoover at the U.S. Department of Commerce, the current state of the U.S. workforce has shifted from the pandemic-induced "great resignation" to a more localized "reshuffling" within communities and regions. While this reshuffling has affected all industry sectors, the manufacturing/durable goods sector is still experiencing a resignation rate of approximately 1.4% [1]. A more pressing concern is the overall workforce participation rate. Ferguson and Hoover report that the workforce still lacks approximately 1.4 million participants compared to the pre-pandemic levels. In other words, even if every qualified person filled an open position, the workforce would still fall short. Despite the manufacturing/durable goods sector post-pandemic recovery, over 600,000 positions remain unfilled as of January 2024 [1] - a figure many believe is significantly underestimated. Although there are many reasons why individuals have recently left their jobs or chosen not to work, the changing nature of work post-pandemic has influenced these numbers, particularly in the manufacturing sector.

Challenges with supply chain capability and capacity threaten U.S. access to products when needed. While most Americans are used to having consistent access to everyday goods, the recent pandemic has showed us the fragility of our supply chains. Having the production depth, capability, and capacity is only part of the issue. The workforce must be *digitally* literate and *cognitively* flexible to be successful in the fourth industrial revolution [2], [3]. Workers need an education and to be trained in the latest manufacturing tools and technologies.

The U.S. once led the world in the production of machine tools, which are essential for manufacturing parts that support the automotive, aerospace, defense, medical, and consumer goods industries. Today, advanced technologies such as computer-controlled machining and 3D printing are transforming how products are made. Because of the sophisticated nature of these machines, it requires a knowledge of geometry, physics, materials, and other science, technology, engineering, and mathematics (STEM) related content to successfully and productively operate them. Once a person is trained, skilled workers can pursue careers such as machine operators, programmers, data scientists, manufacturing engineers, machine designers and entrepreneurs. These trainings and skills should be introduced at an earlier age, such as Kindergarten-12 (K-12), to give students the foundational STEM knowledge needed to pursue careers in manufacturing or related fields, helping them become better prepared and more likely to succeed in an evolving workspace.

To address some of these concerns, staff and faculty from Georgia Institute of Technology and Purdue University led a workshop at a Digital Manufacturing conference attended by industry leaders. This study aims to explore strategies for preparing the future workforce and identify collaborative approaches between industry and education.

Methods and Objectives

Research Design

This study employs a mixed-methods approach, combining quantitative data collected via an online survey with qualitative insights gathered from focus group discussions. The research

study was granted exempt status by Georgia Institute of Technology's Institutional Review Board (IRB).

The conference workshops spanned two days. On the first day, participants completed survey questions and engaged in discussions focused on diagnosing workforce challenges and identifying opportunities. Topics covered included examining the current state of skills shortages across industry sectors, reflecting on existing strategies to cultivate the next generation of skilled workers, evaluating their effectiveness, and discussing potential risks associated with the skills gap, as well as identifying opportunities for improvement.

The second day focused on building actionable strategies. Discussions explored the potential consequences of not addressing these issues, best practices in employee training and development - such as the use of AI-powered learning platforms - and methods for bridging the skills gap. Participants also proposed ideas to attract and retain young talent and underrepresented groups within these sectors.

Participants, Data Sources, and Analysis

This study was conducted at a single location, with participants consisting of industry leaders and professionals from various fields. Attendees had the option to choose from multiple concurrent workshops, and those who selected the workforce development workshop were included in the study. Data collection involved two primary sources: an online survey and focus group discussions.

The online survey, consisting of multiple-choice questions, aimed to gather participants' views on the current state and future outlook of workforce development. During the workshops, participants took part in open discussions focused on their perspectives on workforce development, their engagement with educational institutions, and their unique industry insights and experiences. The data collected from these discussions were analyzed qualitatively using grounded theory to identify key themes, gaps, and opportunities for future research in workforce development.

Results And Discussion

An analysis of the survey questions (N = 8) showed that there is a clear concern for workforce development in the industry, both today (Figure 1) and in the future (Figure 2). While present concerns are moderate, the data suggests an increasing awareness of potential challenges over the next decade. This shift may highlight the need for proactive workforce development strategies, such as education, training, and industry-wide collaboration, to address anticipated needs.

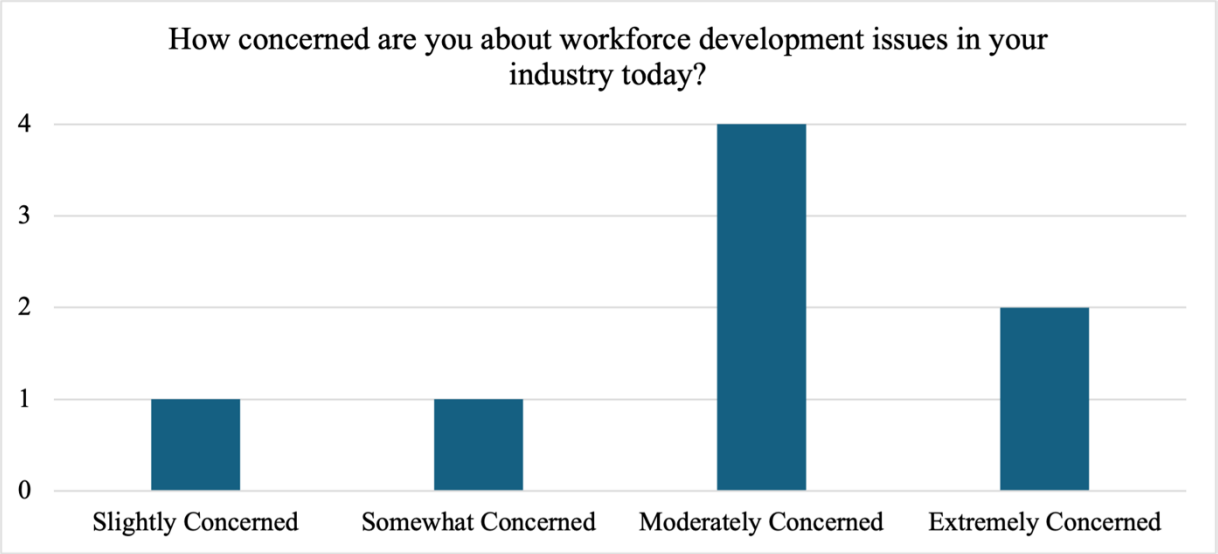

Figure 1: Response distribution for workforce development concerns today.

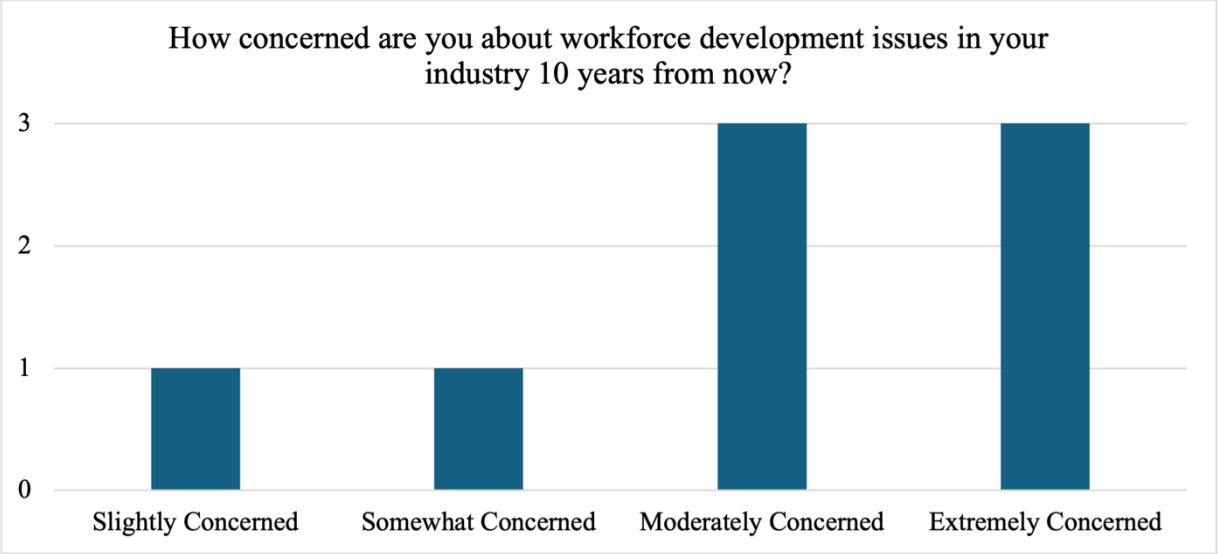

Figure 2: Response distribution for workforce development concerns 10 years from now.

Analysis of the qualitative data revealed the following key themes.

Bridging Knowledge and Skills Gaps between Academia and Industry

A key theme that emerged from the discussions is the gap between academia and industry in terms of knowledge and skills, specifically the miscommunication and/or misunderstanding regarding industry needs and academic training. Participants noted that academia often lacks an emphasis on business and multidisciplinary skills, focusing instead on specialized knowledge within a single area of study. In contrast, industry requires employees to have broader, more integrated skill sets to handle diverse tasks and challenges. Industry also struggles to keep up with technological advancements. In some cases, the incoming workforce, who are digital natives, have a better understanding of technology than the veteran workforce, which has

traditionally been less tech-savvy. Additionally, there is a challenge in transferring knowledge from an aging workforce to new employees, and a limited focus on transferable skills and value-based decision-making. Participants noted that while industry seeks practical, technology-driven solutions, new employees are sometimes hesitant to adopt technology, such as AI, due to discouragement in academic settings. These disconnects lead to inefficiencies and unmet expectations.

Addressing Recruitment, Retention, and Inclusion

Companies highlighted several challenges in recruiting and retaining top talent. One major issue is the need to offer competitive salaries to attract skilled employees. Additionally, recruitment efforts are often geographically limited to areas near a company's location, which restricts the talent pool and reduces diversity. Participants mentioned retaining employees was a challenge, as there is always the risk of losing them to better job offers. Despite these challenges, there are opportunities to promote inclusion and diversity in hiring practices. For example, some companies are recruiting from underrepresented groups through partnerships with community colleges and programs focused on military veterans. Multiple Fortune 500 companies stated they are focused on engaging diverse populations through internships. To improve retention rates, a few companies have focused on promoting internal job growth. Strategies such as rotational programs and clearly showcasing internal job opportunities can help employees see opportunities for long-term careers within the organization. Additionally, "101" training programs are used to build foundational knowledge about specific subjects or products within the company, equipping employees for long-term success.

Enhancing Experiential Learning Across K-12 and Higher Education

Many companies at the conference shared that they primarily recruit from colleges and universities, but it became clear that there is a missed opportunity in starting recruitment or providing opportunities at the K-12 level. Currently, there are fewer opportunities for internships for K-12 students and educators, even though companies have the potential to offer knowledge, training, and real-world experience in both K-12 classrooms and university settings. By doing so, companies can help students at all levels learn trade skills and technology that align with their specific needs, which in turn helps shape the workforce. One discussion topic was the distinction between a field trip and a field experience. While field trips offer limited learning, field experiences provide immersive, interactive learning with real-world applications, allowing students to engage with the company's technology, culture, and operations. There is also a need to strengthen connections between companies, K-12 schools, and universities. By sharing their day-to-day operations, companies can help students explore career options and better equip them for the future workforce. Furthermore, companies can encourage educators to take a big-picture approach in aligning classroom learning with industry requirements. Engaging K-12 students early can spark interest in STEM careers.

Investing in Leadership and Soft Skills Development

During the discussions, participants emphasized the importance the investment of the leadership team is for employee development and team success. They highlighted the need for leaders who can inspire, motivate, and develop their teams rather than simply overseeing their daily tasks. Training leaders in soft skills like teamwork, communication, and collaboration was seen as essential so they could pass these abilities on to their teams. Another key point was the

importance of “hiring the person, not the job” - focusing on aligning the company’s and individual’s core values rather than solely matching trade skills to specific job requirements. Participants stressed that leadership teams should prioritize employee growth, whether through professional, career, or personal development, by investing in long-term skill-building programs. These approaches are impactful because effective leaders create engaged, motivated, and high-performing teams. Behavioral hiring ensures employees are adaptable to changing roles and technologies by focusing on qualities like collaboration and cultural fit, while strong leadership investment builds a skilled and loyal workforce.

Creating Sustainable Workforce Ecosystems

Participants noted the importance of being proactive rather than reactive in addressing workforce challenges. They stressed that companies, teams, and leadership should anticipate potential issues before they arise, instead of responding to each challenge as it occurs. Reactive approaches, such as cutting training budgets to resolve immediate problems, can undermine long-term workforce sustainability. Additionally, companies need to invest in educational partnerships, such as trade skills programs and technical training, by working with local colleges, universities, and trade schools. Leveraging AI platforms and emerging technologies was also seen as a key strategy in sustaining workforce ecosystems. AI can be particularly useful in areas like applicant vetting and employee training, among other applications. Participants reiterated the importance of aligning values and culture during recruitment to ensure better cultural fit and improve retention. They also emphasized the need to broaden recruitment efforts beyond local talent pools to access a more geographically diverse pipeline.

Conclusion

The discussions at the conference highlighted that improving workforce development and addressing the skills shortage required a multifaceted approach that involves efforts across industry, academia, early education, and leadership.

A key takeaway was the importance of bridging the gap between academic training and industry needs. Academia often focuses on specialized, theoretical knowledge, while industry requires employees with practical, multidisciplinary, and business-oriented skills so they can adapt to various and evolving challenges. This disconnect not only leaves graduates underprepared, but it also makes it more difficult for companies to meet operational demands. To address this issue across all education levels, it is equally important to start investing in partnerships that connect K-12 students and educators with industry needs early on. As mentioned, this can be achieved through internships for both students and educators, field experiences, and collaborative projects between schools and industry partners or companies. Strengthening partnerships between K-12 schools, universities, and companies will help students gain exposure to the skills, technologies, and career opportunities that align with current workforce requirements. It also highlights the need for a more flexible K-12 curriculum which emphasizes STEM subjects within the context of vocational- and apprenticeship-based learning.

Technological advancements, changing skill demands, and generational shifts demonstrate the growing need for industries to be proactive in workforce planning. A major takeaway is that companies should prioritize upskilling and reskilling to remain competitive in an evolving

industry landscape. There are opportunities to address these challenges by broadening recruitment efforts to underrepresented groups and expanding outreach beyond local areas. Additionally, retaining employees can be achieved by offering internal growth opportunities, making them feel valued and invested in the organization's success. Leadership also plays a role in employee development and team success. Leaders should create opportunities for growth, whether through partnerships, internal programs, or encouraging other leaders to invest in their teams. As individuals, employees can take ownership of their own learning and development, but it's up to leadership to create a place that supports and encourages this. These approaches are impactful in several ways. Diverse hiring practices foster innovation and creativity by bringing together different perspectives. Expanding recruitment efforts creates stronger talent pipelines, ensuring continuity and future growth. Finally, offering opportunities for internal development, such as rotational programs, reduces turnover, builds employee loyalty, and strengthens the organization.

Looking at workforce development holistically, it becomes clear that the changes needed will take time. It's not just about individual companies or departments making improvements, it's about creating a shared, long-term strategy across industries, education systems, and communities. While this paper represents only a small number of participants and limited views from industry partners, we hope this will serve as a call to action for future programs, ecosystem building, and scholarship in the rapidly burgeoning space of workforce development.

Acknowledgements

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