Fostering AI-Ready Building & Moving CTE Pipelines

Implications for Policy, Practice & Research

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Introduction

Like the cotton gin and the Internet, AI is predicted to fundamentally reshape how, where, when, and what Americans do for work (Cazzaniga et al., 2024; Ellingrud et al., 2023; Makridakis, 2017).

There is widespread speculation that AI will generate new fields of work, more jobs, and overall economic growth (Shine, 2023; Stewart et al., 2015), but this is far from certain (Frey & Osborne, 2017). Indeed, there is little consensus on the degree to which AI might change the number of available jobs (Hatzius et al., 2023; Kessler, 2023).

Less contentious, however, is the belief that AI will likely change the composition of jobs. Existing research is clear: advances in technology have, over time, increased demand for jobs and workers able to perform non- routine, cognitive, and social tasks (Acemoglu & Autor, 2011; Acemoglu & Restrepo, 2019). It is not entirely clear if, and to what degree, the accelerating usage of contemporary AI will reinforce this trend (Bick et al., 2024). Furthermore, not all education providers have the information or resources they need to act today and prepare students for the workplace of tomorrow.

The Education Research & Opportunity Center at the University of Tennessee Knoxville, Advance CTE, and ACTE are partnering on a series of briefs focused on the intersection of AI, workforce development, and community college career and technical education (CTE).

The current brief focuses on how current and projected developments in AI are revolutionizing Building & Moving occupations, the potential exposure of Building & Moving occupations to AI-driven workforce automation, and how Building & Moving CTE providers can prepare their learners for a workplace increasingly shaped by AI technologies. Future reports are set to focus on the remaining Cluster Groupings.

What are Building & Moving Occupations?

The National Career Clusters® Framework managed by Advance CTE provides a shared structure and language for CTE program design across the United States. In 2012, 94% of states had adopted the Career Cluster framework. In 2024, Advance CTE released a modernized Career Clusters Framework designed to serve as a bridge between education and work and a central building block for consistently designed and high-quality CTE programs. This framework includes 6 Career Cluster Groupings that act as purpose-driven meta-sectors that help guide young people toward Clusters that are aligned with their interests, their sense of purpose, and the impact they want to make on their communities.

The Building & Moving CTE Career Cluster Grouping consists of the Supply Chain & Transportation, Advanced Manufacturing, and Construction Career Clusters[1]. The Supply Chain & Transportation Career Cluster appeals to students interested in the transfer, coordination, and management of goods from production to consumption. Sub-Clusters within Supply Chain & Transportation include Ground & Rail Transportation, Maintenance & Repair, and Planning & Logistics. Some occupations within the Supply Chain & Transportation Career Cluster include Automobile Service Technician, Air Traffic Controller, Urban and Regional Managers, and Transportation Inspector.

The Advanced Manufacturing Career Cluster also falls within the Building & Moving Career Cluster Grouping and attracts students with an interest in engineering, design, and equipment maintenance. Sub-Clusters within Advanced Manufacturing include Engineering, Industrial Machinery, and Robotics. Some specific occupations tied to Advanced Manufacturing include Engineer, Industrial Machinery Mechanic, Chemical Plant and System Operator, and Occupational Health and Safety Technician.

Finally, the Construction Career Cluster appeals to students with a desire to design, plan, and manage projects in the built environment. Sub-clusters within Construction include Skilled Trades, Construction Planning & Development, and Architecture & Civil Engineering. Specific occupations within Construction include but are not limited to Architectural and Civil Drafters, Carpenter, Welder, and Urban and Regional Planners. Combined, occupations within the Building & Moving cluster constitute a large and growing segment of the broader US economy.

According to our analysis of 2023 Bureau of Labor Statistics Occupational Employment and Wage Statistics data, Building & Moving occupations employed a total of 38,890,540 workers, which translates into nearly 26% of the total US workforce.

1 https://careertech.org/career-clusters/

Building & Moving Clusters and Sub-Clusters

Supply Chain & Transportation

Air & Space Transportation
Ground & Rail Transportation
Maintenance & Repair
Marine Transportation
Planning & Logistics
Purchasing & Warehousing

Advanced Manufacturing

Engineering
Industrial Machinery
Production & Automation
Robotics
Safety & Quality Assurance

Construction

Architecture & Civil Engineering
Construction Planning & Development
Equipment Operation & Maintenance
Skilled Trades

How is AI revolutionizing Building & Moving Occupations?

Supply Chain & Transportation

AI is revolutionizing Supply Chain & Transportation occupations by enhancing efficiency, accuracy, and decision-making processes. In Air & Space Transportation, AI analyzes real-time data on weather patterns, flight schedules, and airspace congestion to optimize air traffic control (Iyer, 2021). AI-driven systems also now enable dynamic rerouting of aircraft flight routes to protect against delays, fuel overconsumption, and air traffic control inefficiencies. In Ground & Rail Transportation occupations, AI is enabling unprecedented leaps in driverless technology by processing data from sensors to navigate roads, recognize obstacles, and make real-time decisions. Companies like Waymo have expanded their driverless ride-hailing fleets across cities such as Los Angeles and Phoenix, offering 24/7 transportation while accumulating millions of miles (and data) of driving experience (Elias, 2024).

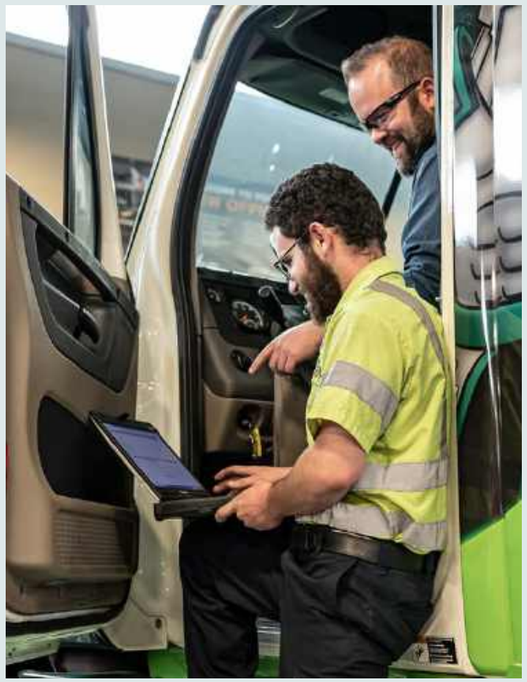
Relatedly, AI-powered systems can now produce real-time traffic data analyses to optimize traffic flow, reduce congestion, and improve road safety (Ponnusamy et al., 2024). Rail transport is also being improved through AI through surveillance for rail irregularities and freight monitoring, planning for train schedules and maintenance, and communication and safety monitoring (Laiton-Bonadiez et al., 2022). The Delaware Department of Transportation (2024), for example, is developing an AI-powered Integrated Transportation Management System to achieve a predictive and adaptive self-monitoring transportation management system.

There are similarly disruptive applications of AI in Planning & Logistics occupations ranging from warehouse automation, fleet management, load optimization, fraud detection, and customer experience. AI algorithms analyze historical sales data, market trends, and external factors to predict future demand (Venkataramanan et al., 2024)

AI-powered systems can also support route optimization by evaluating real-time traffic data, weather conditions, and delivery schedules to determine the most efficient routes for transportation (Vaddy, 2023) and guard against excess operational costs. Major supply chain companies like Amazon and Walmart leverage predictive machine learning algorithms to identify consumers' purchasing patterns, identify efficient routing, and protect against waste. Findings suggest companies who adopt and implement AI-enabled supply chain efforts see meaningful cost reductions and optimized inventory and service levels (McKinsey, 2021, 2024).

INTERVIEW SPOTLIGHT

Nick Goodnight, a veteran automotive and diesel technologies professor at Ivy Tech Community College in Indiana, is confident AI will not eliminate the vast majority of Building & Moving occupations. When he met with our team, he made it clear that AI is transforming the capabilities of skilled technicians working in these fields. Drawing on his own experience as an automotive technician, Dr. Goodnight believes that AI has opened new and exciting possibilities for technicians and consumers. Chief among them are the ways in which contemporary AI help "streamline communication between vehicle and technician, and the communication between the vehicle and the built environment." Coupled with material improvements in cellular networks which have reduced processing latency and accelerated computational speed, Dr. Goodnight believes that "a wave is forming" in the automotive industry "and we are at the top of the wave."



Advanced Manufacturing

Like Supply Chain & Transportation, AI is quickly changing Advanced Manufacturing occupations. For example, AI-powered technologies now enable Advanced Manufacturing firms to identify potential equipment failures before they occur, helping to reduce downtime and waste. AI technologies are also now used to enhance quality control (Javaid et al., 2022). For example, AI computer vision systems use images and sensor data to perform product inspections, detect minute defects and anomalies during manufacturing and transportation, and protect product quality and customer satisfaction. Together, AI's rapid integration in Advanced Manufacturing occupations is promoting enhanced precision, process adaptability, and overall production efficiency (Ani et al., 2024).

Generative AI technologies also enable sophisticated design optimization, allowing engineers to generate and evaluate multiple product design iterations rapidly (Patel et al., 2024). Specific programs like I AutoCAD, Siemens NX, and Sketchup accelerate prototyping and reduce time-to-market, enabling rapid conceptual design iterations (Khanolkar et al., 2023). The integration of Virtual and Augmented Reality (VR/AR) and AI is driving an industrial transformation known as Industry 4.0, or smart manufacturing (Sahu et al., 2020). Research suggests VR/AR technologies can enhance maintenance operations by up to 79% and reduce errors by as much as 92% (Fiorentino et al., 2014).

During assembly processes, AR supports operators by maintaining their focus on tasks and minimizing distractions. Moreover, AR facilitates more efficient onboarding for new operators, enabling them to learn manufacturing processes and environments without the burden of memorizing extensive instructions and manuals (Sahu et al., 2021).

AI also plays an increasingly pivotal role in enhancing safety and environmental protection in Advanced Manufacturing through proactive monitoring, real-time risk detection, and data-driven decision-making. Machine learning models leverage historical data to predict potential safety risks, enabling proactive interventions and strategies to uphold occupational health guidelines and protocols (Fisher et al., 2023; Warrick, 2024).

In manufacturing environments, AI-powered systems can detect subtle anomalies such as potential leaks, spills, and harmful emissions with unprecedented accuracy.

Moving forward, advanced sensor technologies will identify workers who are not wearing protective equipment in addition to signaling equipment failures in real-time (Fisher et al., 2023). Together, these analyses lead to quicker, proactive safety measures.

INTERVIEW SPOTLIGHT

Paul Thurber, vice president and general manager of manufacturing and safety for Everguard.ai, believes that AI-driven solutions won't change the skills workers need to do their job, nor will it discount the necessity for proper onboarding and training. Instead, it will "work as a proverbial tap on the shoulder, saying 'hey, put on your hat,' 'tie off here,' 'don't walk there,' 'that equipment is energized.'" In other words, AI in the industrial space will simply enhance our ability to look out for the worker, even when the worker isn't looking out for themselves. In our recent interview, Paul emphasized that these tools are not coming, they are here, and Everguard.ai has the results to show for it. AI integration decreases the frequency of safety-related incidents, resulting in subsequent savings for the individual and the companies they represent. The power of AI, according to Mr. Thurber, lies in its ability to act as a brother's keeper, objectively watching out for our safety 24/7, 365, without distraction or interruption.

Construction

AI has grown increasingly integral to the construction industry, driving improvements in efficiency, design optimization, and risk management. AI-driven forecasting tools leverage historical project information to perform sophisticated data analyses and recommend strategic interventions (Ghimire & Sagri, 2024; Zhang et al., 2024). Such processes enable more accurate project timeline predictions and resource allocation, protecting against project delays, and optimizing schedules and budget management (McKinsey & Company, 2018; Zhang et al., 2024; Waqar., 2024; Regona et al., 2022).

AI technologies in robotics also optimize construction design and development. Multiple building models can be generated to systematically evaluate and select architectural solutions predicted to be the most efficient and cost-effective. Further, generative site design leverages AI to conduct geospatial data analyses, optimizing site selection and planning based on environmental and demographic factors. Robotic arms equipped with 3D printing capabilities enable on-site fabrication of building components, offering more flexible and expedited construction methods.

Repetitive construction tasks such as bricklaying and concrete pouring are being transformed by AI-powered robotics, delivering unprecedented levels of precision while simultaneously reducing labor costs and protecting against human error (Pastrana et al., 2023; Taiwo et al., 2024). These advanced platforms not only improve operational efficiency and precision but also provide remarkable adaptability to complex project requirements.

INTERVIEW SPOTLIGHT

In a recent interview with our team, Tim Sisson with Trane Technologies shared how AI is shaping Trane's ability to provide enhanced HVAC products and services to clients. For example, he described how advanced computer modeling and AI can be used to create virtual twins. These virtual twins are exact virtual replicas of physical objects and are used to simulate processes before they happen. Modeling technologies coupled with AI help Trane and other Advanced Manufacturing firms better monitor systems, predict and prepare for potential failures. For instance, in California, AI-driven computer models are used to simulate earthquakes and help Trane manufacture HVAC systems that will continue to circulate clean air in crucial buildings like hospitals.

Autonomous vehicles transport materials across sites and robotic equipment executes tasks such as excavation and grading. These advancements increase efficiency while reducing reliance on manual labor. Boston Dynamics' Spot robot exemplifies this by autonomously navigating sites, conducting inspections, and collecting data using AI for dynamic sensing and obstacle avoidance.

Outside of enhancing efficiency and precision, AI developments promise safer conditions for construction workers. Beginning at training, AI-driven simulations create immersive, realistic scenarios that allow workers to develop critical safety skills in controlled environments. These advanced learning platforms enable workers to recognize and respond to potential dangers more effectively, ultimately reducing workplace risks. By supporting and augmenting human capabilities, robotic systems like AI-powered exoskeletons guard against workplace injury while improving overall worker productivity. AI-powered wearable devices represent another critical advancement in worker safety. These devices continuously monitor workers' vital signs, fatigue levels, and environmental conditions.

By generating immediate alerts for potential risks such as heat stress, excessive exhaustion, or injury indicators, these technologies provide proactive safety management that can protect against workplace incidents before they occur. Additionally, drone technology has revolutionized site monitoring and inspection processes. Equipped with AI-powered imaging capabilities, drones conduct comprehensive structural assessments, track project progress, and identify potential safety risks or structural anomalies that might elude traditional human inspection methods. In sum, these developments promise to further revolutionize construction industry practices, promoting more integrated, intelligent, and responsive project management approaches (Taiwo et al., 2024; Zhang et al., 2024).

Will AI Automate Building & Moving Occupations?

Tasks constitute jobs, jobs constitute occupations, and occupations constitute industries (U. S. Government Accountability Office, 2022).

Technological development can either substitute or complement the human skill required to complete job-related tasks. Substitution occurs when technology replaces human skill to perform a task. If enough tasks are substituted, the probability of occupation-level automation increases (U. S. Government Accountability Office, 2022). But substitution is not the only outcome; by contrast, technologies can complement and enhance the human skills needed to complete tasks, increase task efficiency, bolster demand for those technologies and skills, and even create new jobs. Put simply, there is a long-standing recognition that technologies act on tasks directly, and occupations only indirectly (Acemoglu & Autor, 2011; U. S. Government Accountability Office, 2022).

There is no doubting whether existing and projected AI technologies will change the tasks and skills required to perform jobs in Building & Moving occupations. The question centers around what this change might look like and whether we can expect AI to drive task substitution, complementarity, and/or creation.

According to our analysis of O*NET occupational skills data, the most prominent skills required to perform jobs in the Building & Moving occupations are both technical (e.g., repairing, operation and control, and equipment maintenance) and transferable (e.g., negotiation, active listening, speaking, critical thinking). Technical skills are specific to Building & Moving job related tasks. For example, technical skills include welding, pipefitting, and computer program coding. On the other hand, transferable skills transcend specific occupations and can be applied in different settings and tasks. These skills include active listening, critical thinking and deductive reasoning are transferable skills. The distinction matters because existing research suggests transferable skills are less prone to AI-driven automation.

Appendix Tables 1-3 list the 10 largest occupations in the Building & Moving Career Clusters (by 2023 employment, according to the Bureau of Labor Statistics) and the five most important skills required of those occupations[2]. Appendix Tables 1-3 also include two measures for understanding the degree to which AI may impact these Building & Moving occupations by focusing on the task/ skill composition within them. The first measure is the Artificial Intelligence Occupational Exposure (AIOE) index (Felten et al, 2021) which quantifies the degree to which capabilities (i.e., skills) of AI overlap with the task and skills for specific occupations (e.g., Plumbers). The AIOE index is standardized with a mean of 0 and standard deviation of 1. Higher AIOE scores can be interpreted as greater occupational exposure to AI; lower scores are interpreted as less occupational exposure to AI. Our findings show that increases in technology over time correspond to an increasing premium on jobs with a high share of nonroutine tasks, otherwise understood as tasks that cannot be easily automated by available technologies.

The second measure is the Task Routinization Index (Acemoglu & Autor, 2011). Unlike the AIOE which assigns a single score to an occupation, the Task Routinization Index decomposes occupations into tasks that are either routine/non-routine and/ or cognitive/ manual and determines how relevant each category of task is within an occupation. Scores on the Task Routinization Index range from 1 (not important) to 5 (very important).[3]

One can see from Appendix Tables 1-3 that there is wide variation in AIOE and Task Routinization Index scores across the most prominent occupations within the Building & Moving Cluster Grouping. Overall, AIOE scores tend to be lower than the average for all US occupations (as evidenced by the negative AIOE scores). This is a good thing for those concerned about loss of jobs in this area, as it suggests that Building & Moving occupations are less exposed to contemporary AI capabilities relative to other Career Clusters.

The few exceptions are the “high skill” Building & Moving occupations that have higher education entry level requirements such as Industrial and Civil Engineers, and Construction Managers. This is likely explained by the high share of both routine and non-routine cognitive tasks required to perform these occupations and the fact that AI is believed to have limited influence on the role of physical abilities in occupations and industries” and is “likely to have the biggest impact on abilities related to information processing” (Felten et al, 2021, p. 2203) and other cognitive tasks. In short, experts have demonstrated that the relationship between AI, including Generative AI, are strongest for cognitive abilities. This is why physicists, for example, have greater exposure to AI than surgeons. Both occupations require cognitive abilities, but surgeons rely much more heavily on a broad range of abilities including dynamic physical, psychomotor, and sensory abilities (Felten et al, 2021).

Figure 1 of the Appendix provides visual confirmation that Building & Moving occupations have slightly above average or less than average AI occupational exposure relative to all occupations. As one can see, occupations linked to Advanced Manufacturing programs have an average AIOE score that is just slightly above the overall average, while occupations linked to the Construction and Supply Chain & Transportation Career Clusters have average AIOE scores that mirror the national average for all occupations. Importantly, Figure 1 of the Appendix also illustrates that there is a high degree of variation across occupations requiring different entry education levels. Across the board, occupations requiring a bachelor’s degree or higher are at greatest AI exposure. By contrast, occupations requiring just a high school degree or less are the least exposed to AI. This is likely for two reasons. First, cognitive tasks predominate within occupations requiring more formal education. (Appendix Tables 1-3; Acemoglu & Autor, 2011). There is a strong overlap between the capabilities of contemporary AI and human cognitive abilities, such as information processing (Brynjolfsson & Mitchell, 2017; Felten et al, 2021).

Importantly, AIOE scores alone cannot tell us how AI will impact demand for occupations. The AIOE index simply correlates human and AI abilities in specific occupational settings. It is natural, therefore, to conclude that occupations with higher AIOE scores would be at greater risk of AI-driven automation. Yet, while automation is certainly a possibility and existing research illustrates that smart machines have, over time, eliminated occupations heavily reliant on routine manual and cognitive tasks, it is equally possible that occupations with AIOE scores would require more human workers to develop, utilize, monitor, and refine AI technologies in those occupations.

Simply put, where there are higher AIOE scores, there is a higher likelihood that AI will be integrated into those fields of work.

Therefore, Figure 1 of the Appendix suggests that many Building & Moving occupations - especially those requiring a bachelor’s degree - may be increasingly dependent on AI not for replacing human labor, but for enhancing it.

2 We used Bureau of Labor Statistics’ Occupational Employment and Wage Statistics data to determine 2023 employment by 6-digit Standard Occupational Classification (SOC) code. We used O*NET Knowledge, Skills and Abilities data to identify the top skills for each SOC.

3 The Task Routinization Index (Acemoglu & Autor, 2011) decomposes occupations into task categories, according to the influence of AI and automation technologies (using O*NET measures for the importance of tasks to an occupation). We aggregate scores back to the SOC level by averaging the task importance within each category for each occupation.

“We find that the most exposed industries tend to be white collar industries requiring high levels of education, such as financial services, accounting, insurance, and legal services. Perhaps not surprisingly, exposure to AI is particularly high in certain service industries that involve a high level of information processing. On the other hand, the lowest-scoring industries tend to be blue-collar industries that involve manual labor, such as support activities for crop production, building and dwellings services, construction contracting services, and warehousing and storage.”

Felten et al, 2021, p. 2203

How Can Building and Moving Students Thrive in an AI Driven Workforce?

Career and technical education providers, industry partners, and policymakers can act now to ensure that students gain the skills and literacies needed to thrive in an increasingly AI-driven work environment. While our analysis show that Building & Moving occupations are not likely to be entirely automated by AI, there is no doubting that AI will change the skill composition required for future workers. These jobs will become increasingly reliant on a variety of AI technologies. As we discussed, AI is already flowing into the work-related tasks in Supply Chain & Management, Advanced Manufacturing and Construction. It is critical, therefore, that the next generation of CTE programs are designed with these developments in mind.

Career and Technical Education Providers

SHIFT THE NARRATIVE

Much of the conversation around AI in the classroom has been dominated by concerns for academic dishonesty and plagiarism, if not neglected entirely. The reality is that AI is fundamentally changing the world of work students are training for. Exposing students to AI tools and technologies cannot be optional, it must be mandatory. Every course and every program within the Building & Moving Cluster Grouping must train students on AI applications in the fields of work they are preparing for. Jensen Huang, CEO of NVIDIA, explains why: “If you are not engaging AI actively and aggressively, you are doing it wrong. You are not going to lose your job to AI, you’re going to lose your job to someone who uses AI.” There is evidence that colleges serving more affluent students are more likely to offer training, courses and programs in AI compared to open access institutions like community colleges (Palmer, 2025). Elite institutions cannot be the only ones aggressively engaging AI; community and technical colleges providing Building & Moving courses and programs must do the same.

FOCUS ON SKILLS, NOT ONLY JOBS

It is exceedingly difficult to predict which individual occupations will be impacted - positively or negatively - by AI (Merisotis, 2020). Not only is it guesswork, but it is also flawed thinking, rooted in a misunderstanding of how technology impacts work (Acemoglu & Autor, 2011; Park & Kim, 2022).

Technology does not impact occupations directly, it acts on them through tasks and skills and the traditional approach to thinking of education in terms of majors, courses, and degrees does learners a disservice.

By contrast, our focus needs to be on the skills students enrolled in Building & Moving programs of study/pathways acquire. Technical skills are crucial for Building & Moving occupations, but the growing influence of AI in Building & Moving sectors means learners must also acquire skills to generate (e.g., prompt engineering) and critically audit and assess AI output. These skills, along with fundamental skills in critical thinking, group communication, creativity, problem-solving, and research, will be essential for carrying out job-related tasks in all occupations, including those in the Building & Moving Clusters.

Appendix Tables 1-3 show that the most heavily employed Building & Moving occupations already require these skills. But how will AI change what they look like in practice, on the job? For example, what does quality control analysis, writing, critical thinking, judgment and decision making, and reading comprehension look like for Inspectors, testers, sorters, samplers, and weighers in the AI age? These are critical questions for community college leaders, faculty, and industry representatives to ask and answer.

Industry Partners

BRIDGE THE GAP(S)

Rapid advances and deployment of AI across Building & Moving occupations emphasizes the importance of industry partnerships. Education providers cannot prepare students for AI-driven Building & Moving occupations without knowing the AI technologies and applications employers are focused on. This is the purpose of local workforce advisory boards as well as numerous federal and state policies designed to close the gap between educators and employers. At the same time, numerous CTE educators and industry representatives have shared that industry itself is unsure of the AI landscape and how to respond. One community college dean told us that he was often the voice of authority and information on AI during meetings within industry partners. The challenges of keeping ahead of AI developments and knowing precisely how to deploy AI are particularly acute for small and medium sized businesses and especially those in rural areas.

Industry partners can support the work of community and technical college Building & Moving programs by identifying and sharing the AI applications and use cases in their industry. Industry partners can also aid providers by advocating for the AI skills they need and will be hiring for. Industry can further assist by equipping Building & Moving classrooms with next generation AI-driven software, machines, technologies, and robotics so students access and train on them immediately.

Policymakers

BUILD ON WHAT WORKS

Recent changes to federal CTE and workforce education policies have given community and technical colleges, as well as employers, many helpful tools to work with. For example, the comprehensive local needs assessment within Perkins V is a fantastic framework on which to build and strengthen private/ public partnerships to address the AI exigency. This particular policy requires community and technical college CTE providers to assess local labor market conditions and consult with stakeholders, including local businesses, to help make funding decisions. This policy mandate should be leveraged and improved to address any emergent AI skills mismatches in local economies.

Similar to Perkins, additional policy efforts are needed to increase funding for apprenticeship and work-based learning programs, which would enable students to gain tangible, occupation-specific AI applications and skills. Policymakers need to act to ensure community and technical college students have access to meaningful learning opportunities at places of work where AI innovations will first appear.

INVEST IN THE FUTURE

It is crucial that Building & Moving classrooms give learners access to the most innovative, state-of-the-art AI tools and technologies. Industry partnerships are crucial for this reason: as close collaborators, industry partners and local employers can provide community and technical colleges with real-world equipment for students to train on. This may include advanced, AI-powered electric vehicles, AI-enabled diagnostic technologies, AR/VR wearables, or robotics for large-scale manufacturing. These technologies are expensive, however, and not every community and technical college can count on local employers for learner access. One community college dean estimated that building a modern automotive technologies program can cost over $1M to establish, and additional thousands to maintain and update. Recruiting and retaining trained faculty is additional challenge and cost. Policymakers can help by continuing to funnel investments that foster private public partnerships and help CTE providers gain classroom access the technologies students will later use in the workplace.

Conclusion

Supply Chain & Management, Advanced Manufacturing, and Construction provide bright, innovative, and hands-on learners with exciting, rewarding, and remunerative career pathways.

Unsurprisingly, Gen Z workers are increasingly interested in trades-based work and the so-called “toolbelt generation” (Chen, 2024) will buoy the Building & Moving workforce, which represents a large and growing segment of the broader US economy. This said, AI will have massive impacts on Building & Moving work. AI may substitute some routine and repetitive job-related tasks and even entirely automate some roles, but the vast majority of Building & Moving occupations will persist and workers with the right combination of technical and transferable skills and AI literacies will thrive. It is the job of the nation’s community and technical colleges to prepare learners for this future.

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TABLE 1

Largest Occupations, top skills, and AI Occupational Exposure: *Advanced Manufacturing*

Occupation	Top Skills	AIOE	Routine Manual	Non-Routine Manual	Routine Cognitive	Non-Routine Cognitive
Misc. assemblers and fabricators	• Active Listening • Monitoring • Quality Control Analysis • Operation Monitoring • Reading Comprehension	-0.90	3.50	3.06	3.30	2.95
First-line supervisors of production and operating workers	• Active Listening • Speaking • Management of Personal Resources • Time Management • Social Perceptiveness	-0.08	3.48	2.74	3.12	3.68
First-line supervisors of mechanics, installers, and repairers	• Monitoring • Management of Personnel Resources • Coordination • Judgement and Decision Making • Speaking	-0.08	2.54	2.85	3.19	3.55
Inspectors, testers, sorters, samplers, and weighers	• Quality Control Analysis • Writing • Critical Thinking • Judgement and Decision Making • Reading Comprehension	-0.03	3.20	2.79	3.40	2.87
Welders, cutters, solderers, and brazers	• Quality Control Analysis • Monitoring • Judgement and Decision Making • Critical Thinking • Operations Monitoring	-1.20	3.20	3.13	3.31	2.67
Industrial machinery mechanics	• Quality Control Analysis • Monitoring • Judgement and Decision Making • Critical Thinking • Operations Monitoring	-1.13	3.68	3.56	2.99	2.47
Industrial engineers	• Reading Comprehension • Complex Problem Solving • Writing • Critical Thinking	1.14	2.01	1.73	2.92	3.51
Machinists	• Operation and Control • Monitoring • Critical Thinking • Operations Monitoring • Speaking	-0.87	4.35	3.32	3.54	2.78
Mechanical Engineers	• Critical Thinking • Complex Problem Solving • Reading Comprehension	1.00	2.19	2.04	2.94	3.59
Industrial Production Managers	• Speaking • Active Listening • Coordination	0.51	2.72	2.20	3.15	3.74

TABLE 2

Largest Occupations, top skills, and AI Occupational Exposure: *Supply Chain & Transportation*

Occupation	Top Skills	AIOE	Routine Manual	Non-Routine Manual	Routine Cognitive	Non-Routine Cognitive
Laborers and freight, stock, and material movers, hand	• Operation and Control • Operations Monitoring • Monitoring • Active Listening • Coordination	-1.71	2.97	3.31	3.31	2.37
Stockers and order fillers	• Active Listening • Reading Comprehension • Service Orientation • Social Perceptiveness • Speaking	-0.65	3.38	2.86	3.61	3.16
Heavy and tractor-trailer truck drivers	• Operations Monitoring • Operation and Control • Monitoring • Troubleshooting • Critical Thinking	-1.15	3.29	3.88	3.04	2.82
Light truck drivers	• Monitoring • Speaking • Reading Comprehension • Active Listening • Operation and Control	-1.12	2.67	3.55	2.90	2.66
Shipping, receiving, and inventory clerks	• Speaking • Reading Comprehension • Active Listening • Time Management • Critical Thinking	-0.75	2.95	2.88	3.48	2.97
Industrial truck and tractor operators	• Operation and Control • Operations Monitoring • Coordination • Equipment Maintenance • Time Management	-1.40	3.32	3.94	3.31	2.96
Automotive service technicians and mechanics	• Repairing • Troubleshooting • Critical Thinking • Operations Monitoring • Equipment Maintenance	-0.95	3.02	3.73	3.21	3.10
Packers and packagers, hand	• Monitoring • Critical Thinking • Active Listening • Coordination • Reading Comprehension	-1.51	3.38	2.86	3.61	3.16
Supervisors of transportation and material moving workers, except aircraft cargo handling supervisors	• Management of Personnel • Resources • Time Management • Coordination • Active Listening • Speaking	-0.65	2.65	2.67	3.12	3.65
Buyers and purchasing agents	• Negotiation • Reading Comprehension • Speaking • Complex Problem Solving	0.85	2.03	1.63	3.24	3.42

TABLE 3

Largest Occupations, top skills, and AI Occupational Exposure: *Construction*

Occupation	Top Skills	AIOE	Routine Manual	Non-Routine Manual	Routine Cognitive	Non-Routine Cognitive
Maintenance and repair workers, general	• Equipment Maintenance • Repairing • Troubleshooting • Critical Thinking • Operation and Control	-1.71	2.97	3.31	3.31	2.37
Construction laborers	• Speaking • Coordination • Operation and Control • Active Listening • Operations Monitoring	-0.65	3.38	2.86	3.61	3.16
First-line supervisors of construction trades and extraction workers	• Coordination • Speaking • Management of Personnel • Resources • Coordination • Time Management	-1.15	3.29	3.88	3.04	2.82
Electricians	• Troubleshooting • Repairing • Speaking • Critical Thinking • Active Listening	-1.12	2.67	3.55	2.90	2.66
Carpenters	• Critical Thinking • Monitoring • Active Listening • Coordination • Speaking	-0.75	2.95	2.88	3.48	2.97
Operating engineers and other construction equipment operators	• Operations and Control • Operations Monitoring • Equipment Maintenance • Monitoring • Active Listening	-1.40	3.32	3.94	3.31	2.96
Plumbers, pipefitters, and steamfitters	• Installation • Critical Thinking • Reading Comprehension • Quality Control Analysis • Active Listening	-0.95	3.02	3.73	3.21	3.10
Heating, air conditioning, and refrigeration mechanics and installers	• Operations Monitoring • Troubleshooting • Critical Thinking • Installation • Repairing	-1.51	3.38	2.86	3.61	3.16
Construction managers	• Management of Personnel • Resources • Coordination • Time Management • Monitoring • Active Listening	-0.65	2.65	2.67	3.12	3.65
Civil engineers	• Reading Comprehension • Writing • Judgment and Decision Making	0.85	2.03	1.63	3.24	3.42

FIGURE 1

Average Artificial Intelligence Occupational Exposure Scores for Building & Moving Career Clusters