The Alliance for Learning Innovation (ALI) brings together more than 130 education non-profits, philanthropy, and the private sector organizations to advocate for building better education research and development (R&D) infrastructure. ALI calls for increased education R&D capacity and supports the development of evidence-based innovation that improves talent pathways, expands the workforce needed in our rapidly changing world, and centers students and educators. ALI recommends that the National Science Foundation (NSF) Directorate for Technology, Innovation, and Partnerships (TIP), together with the Directorate of STEM Education (STEM EDU), support the research, development and scaling of education and workforce innovations that will power the advanced manufacturing sector and leverage the potential of emerging technologies to maintain global competitiveness and protect national security interests in the U.S.

1a. Where the needs are located, how the needs are changing over time, and the gaps that exist in current workforce development activities.

A core challenge of U.S. advanced manufacturing is the growing gap between job demand and availability of workers equipped with the technical, digital, and cross-disciplinary skills required for modern production environments. According to projections by the Semiconductor Industry Association, over 2 million manufacturing jobs may go unfilled by 2030 due to existing education and training trends. The gaps that exist in current workforce development activities include 1) limited access to hands-on learning experiences and awareness of manufacturing career opportunities, 2) lack of federal R&D funding for workforce development programs in emerging technology fields and 3) lack of federal investments in quick-turnaround, scalable, and high-reward education and workforce solutions.

To address these challenges, the workforce development strategies for advanced manufacturing, energy, and emerging technologies should be focused on creating a better-connected workforce and education system that is evidence-based and designed intentionally to prepare students for success in these critical fields. As shared in the recent response on the National Strategic Plan for Advanced Manufacturing, ALI supports the creation of a National Center for Advanced Development in Education (NCADE) at the Institute of Education Sciences (IES) to support high-impact, translational education and workforce research that can strategically inform federal investments in effective programs and efforts to scale successful innovations. Additional investments by NSF TIP and STEM EDU could support quick-turnaround, scalable, and high-reward education and workforce solutions.

1.e. How you would leverage existing and other new shared infrastructure to enable applied learning experiences in your industry.

ALI sees many opportunities for NSF TIP and STEM EDU to leverage existing workforce development infrastructure, and recommends that the agency build on these efforts across all levels of government by partnering with trusted intermediary organizations. Intermediaries leverage their local context and expertise to connect federal resources and funding, and strategically meet the unique needs of their region. NSF TIP and STEM EDU should continue to invest in public-private partnerships (PPPs) to drive innovation and scale solutions by pooling resources and aligning incentives among industry and government stakeholders. An excellent example of a PPP in action supporting a critical technology area is the NSF-led National Artificial Intelligence Research Institutes, which demonstrates how collaboration across government, academia, and industry can align research with practical applications. Finally, NSF should also partner with state governments, including state education agencies, to ensure cohesion between federal and state workforce development strategies.

Federal agencies are well-positioned to drive progress on large-scale challenges through coordinating and combining their capacities and resources. For example, ALI commends the cross-agency collaboration that produced this report bridging the perspectives and expertise of the U.S. Departments of Labor, Commerce, and Education on workforce development. Additionally, TIP and STEM EDU could partner with Regional Educational Laboratories (RELs) to help find solutions to pressing workforce needs related

to emerging technologies. RELs are required by current statute to partner with districts, states, and other education stakeholders to identify high priority needs and ensure that research is conducted to address them. NSF could leverage their existing infrastructure to improve understanding of emerging technology workforce needs. IES' Accelerate, Transform, and Scale (ATS) Initiative, which is focused on investing in quick-turnaround, scalable, and high-reward educational solutions, could be another strong partner for TIP and STEM EDU given its complementary focus on applied and translational research.

1.f. How you would create and disseminate information to increase awareness of your industry, region, and career pathways.
NSF could invest in modern infrastructure for knowledge mobilization to disseminate research findings that can improve programs and practice. Some relevant examples from ALI's policy brief "Knowledge Mobilization to Improve Student Outcomes" include:

- **Coalesce and Publish Research Findings.** Evidence synthesis, or making the results of research more accessible and actionable, is a major opportunity for the federal government to provide value to the ed R&D ecosystem. If R&D is to truly drive better outcomes in teaching and learning, research agency leaders should regularly convene, publish research findings, and leverage implementation science on the federal government's platform to keep state and local education leaders and the general public informed on evolving insights.
- **Expand the Centers for Transformative Education Research and Translation (CTERT).** As part of the CHIPS and Science Act, Congress authorized these multidisciplinary centers housed at NSF to support R&D on widespread and sustained implementation of STEM education innovations. While one center has launched, CTERTs can expand to focus on emerging technologies and workforce development, ensuring evidence-based approaches are being brought to bear across the entire education-workforce continuum.

2. If you have feedback, questions, areas of concern, and/or suggestions on priority area that should be addressed, including perspectives on the use of Other Transactions Authority.
Leadership from the federal government is essential for ensuring that we have a sufficient evidence base to effectively grow, improve, modernize, and maintain global competitiveness in the advanced manufacturing sector. Workforce development efforts are too often formed without participation from the K-12 education system leaders who engage potential talent first and develop their foundational skills.. NSF should continue to support the collaboration of education and workforce systems to address emerging technology workforce needs. Addressing workforce development challenges for advanced manufacturing and other emerging technology areas requires a multi-pronged approach that begins with strengthening the STEM education pipeline by investing in research-backed strategies including dual enrollment, early college high school models and apprenticeship and pre-apprenticeship programs, that boost engagement and performance in STEM subjects.

Finally, ALI is supportive of the use of Other Transactions Authority (OTA) when it is used to offer flexible payment mechanisms, such as milestone payments as a means for incentivizing innovative approaches to developing new, evidence-based interventions. While IES does not currently have OTA, its Seedlings to Scale program may provide a useful model for education funding programs structured around meeting milestones for continued funding as NSF considers use of OTAs and other innovative funding mechanisms.