Required information for RFI submission form:

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- **Areas of experience or expertise of the authors**: The Alliance for Learning Innovation (ALI) is a coalition of philanthropy, private sector, and educational nonprofits, that advocates for research-based innovations in education. ALI advocates for increased capacity of education R&D and supports the research and development of evidence-based innovation in education that centers students and practitioners, advances equity, improves talent pathways, and expands the workforce needed in a globally competitive world.

Question 1: Describe the greatest opportunities and/or challenges to creating flexible and affordable training programs (for technicians, practitioners, researchers, students, etc.) needed to build an inclusive, well-paid, domestic workforce in emerging technology careers. (600 words)

Increased integration between the K-12 education system and other STEM stakeholders is the greatest challenge to building an inclusive and high-skilled domestic workforce in emerging technologies and supporting flexible and affordable training programs. K-12 education is critical to ensure the longevity and scaling of any investment made by NSF to strengthen accessibility to career pathways in emerging technology areas. Without well-developed pathways that begin in K-12, the talent needed to continue to build on workforce development investments by NSF will be missing.

NSF should consider mechanisms to foster partnerships between K-12 school systems and other emerging technology stakeholders to increase the flexibility and affordability of training programs. This could be achieved a number of ways, including by creating a resource for schools, industry, and institutions of higher education to use to find partners interested in developing career pathways in specific emerging technology fields, similar to the map created for the Regional Innovation Engines program to help teams interested in applying find relevant partners. Additionally, NSF should require, or at the very least strongly encourage, inclusion of K-12 stakeholders in future workforce development funding opportunities for emerging technology areas. This engagement could come through support for experiential learning, including cooperative education, youth and pre-apprenticeships, and pathways that connect students, communities, and employers.[1] NSF should also look at efforts that ease distinctions between high school and college to create "new configurations that open the opportunity for all students to start on a path toward a postsecondary credential and prepare for a career—free of charge."[2]

K-12 education provides the entry point for America's students into these careers, and it is essential to get students interested in these fields as early as possible. As noted by a 2018 Brookings report on the role of AI in education and the U.S. workforce, schools are an essential factor in ensuring students remain competitive in the labor market as emerging technology like AI changes the landscape of the U.S.

[1] https://delawarepathways.org/
[2] https://jfforg-prod-new.s3.amazonaws.com/media/documents/JFF_Big_Blur_Executive_Summary.pdf

workforce.[3] Integrating K-12 into training programs would provide an affordable pathway into emerging technology careers by leveraging public schools to provide training programs for free or at low cost to enrolled public school students. Not only would this be an affordable option, but introducing students to emerging technology career pathways while they were still in K-12 could allow students to explore a range of options before committing to a singular pathway, ultimately saving them time and resources compared to if they entered and paid for a training program after leaving postsecondary education that they end up not completing.

While institutions of higher education are regularly engaged by NSF in relation to STEM workforce development, K-12 engagement is less common. NSF should use the opportunity presented by the need to create flexible and affordable training programs to more fully engage the K-12 education system to ensure the availability of a prepared and diverse domestic STEM workforce in emerging technology areas of national importance.

Question 2 (maximum 600 words): What have been some of the most effective strategies to removing barriers and providing support for a diverse, inclusive STEM student population and STEM workforce in emerging technology fields?

One effective strategy for removing barriers and providing support for a diverse and inclusive STEM student population is to ensure that K-12 educators have access to and time to complete professional development that supports their teaching of educational concepts required to support future careers in emerging technology fields. Research conducted by Evalworks in coordination with WakeEd Partnership and Wake County Public Schools demonstrates the need for teachers to have both skills related to how STEM is taught to students and an understanding of the content knowledge to effectively teach science and technology concepts in the K-12 classroom. The study conducted by EvalWorks showed that teachers need anywhere from 30-80 hours of instruction, coaching, and practice before successfully mastering new skills.[4] It is essential that teachers have the ability and confidence to teach STEM concepts to students so that students can be prepared for success in emerging technology fields. As such, increased investment into meaningful, evidence-based teacher professional development and training in the STEM fields that support emerging technology fields should be considered. Paid earn-and-learn experiences, including apprenticeships, have been shown to help advanced diversity in workforce development.[5]

Soliciting inputs from historically marginalized and underrepresented populations will be key to ensuring NSF's efforts to build emerging technology career pathways are advancing economic and social mobility. California's "Cradle-to-Career Data System" is an example of an approach to ensure genuine input from marginalized communities. The effort pulled in community groups in addition to the traditional representation from state agencies, educational institutions, research and policy organizations in the design of the system.

Furthermore, NSF should consider mechanisms to increase funding to research successful and innovative STEM education practices and ensure that knowledge gained from STEM education research is being

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[3] https://www.brookings.edu/research/the-role-of-ai-in-education-and-the-changing-u-s-workforce/.

[4] https://kenanfellows.org/journals/wp-content/uploads/sites/377/2020/06/Professional-Development-that-Changes-Teaching.pdf.

[5] https://www.apprenticeship.gov/sites/default/files/Diversity-and-Inclusion-JFF-Case-Study.pdf

mobilized in K-12 classrooms. ALI is very supportive of the NSF Centers for Transformative Education Research and Translation that were authorized through the *CHIPS and Science Act of 2022* and are energized by the centers' potential to accomplish both goals should they be competed and funded. Increasing easy access to evidence-based teaching methods for U.S. educators in easy-to-understand formats will decrease barriers to STEM education by helping more educators find better ways to teach the science concepts essential for student success in careers in emerging technology fields. These Centers would be able to target specific populations (urban, rural, under-represented minorities, special education, etc.) in addition to targeting or supporting the development of resources in specific or categories of emerging technologies.

Question 5 (maximum 600 words): Describe strategies to leverage cross-sector resources, including those of industry, academia, government, philanthropy, non-profits, and any other sectors interested in the future emerging technology workforce. Name key partners with whom NSF could work in this endeavor and provide their expertise and contact information.

Greater involvement of the K-12 education system creates an opportunity to smooth a learner's ability to transition from one educational pathway to another, especially as students exit secondary education and embark on a career pathway. This is especially true given the continued blurring of education and workforce development due to the acceleration of technology and its new demands for new models of learning and creation of new occupations. NSF should increase partnerships with K-12 ecosystems by involving more students, teachers, and parents in their efforts to build pathways into emerging technology fields. By doing this, NSF can help address talent needs and shortages before they become acute and can proactively invest in the United States' future global competitiveness in crucial industries. In addition, future investments in workforce development for emerging technology fields should focus on increasing alignment between K-12 and postsecondary education programs with workforce needs and provide middle and high school students with the skills and information needed to access career pathways in these fields.

Further partnerships with philanthropic funders could help better understand challenges related to a learner's ability to transition between educational pathways and uncover best practices for supporting lifelong learning. By better engaging, encouraging, and rewarding the involvement of philanthropic funders in grant applications, NSF can maximize its existing and future investments, increase public-private partnerships in service of life-long learning, and leverage the community-based relationships of philanthropy to mobilize the knowledge created by supported projects and raise awareness of potential learning and career pathways for students and their families. An example of a successful partnership at NSF with philanthropic funders is the $8.6 million partnership with the Walton Family Foundation, Schmidt Futures, and Bill & Melinda Gates Foundation to improve STEM education.

As mentioned previously, ALI supports the NSF Centers for Transformative Education Research and Translation (CTERTs) that were authorized through the *CHIPS and Science Act of 2022* and believe they have the potential to have a great impact on emerging technology fields, including through leveraging cross sector resources to build up the emerging technology workforce. CTERTS could leverage funds and /or expertise from all listed sectors to build a knowledge base around what works regarding STEM education and career pathways in emerging technology fields for all levels of learners. If the United States is to have a prepared and diverse STEM workforce in emerging technology fields, an all hands on deck effort will be required.

In addition to critical partnerships with K-12 schools and philanthropy, NSF should engage with other federal agencies that have vested interests in emerging technologies and workforce development, including the Department of Defense (DOD), the Department of Education (ED), the Department of Labor (DOL), and the Department of Commerce (DOC). This would avoid duplication and siloing of efforts and leverage the strengths of each agency (e.g. DOD's needs for particular technologies or DOL's expertise in engaging workforce development boards).