

HiPOP: Policy Recommendations

Based on the partner policy reports and the HiPOP survey among US and European CS&E/HPC communities of practice, the HiPOP team finds that the use of WEB technology for education, outreach and training is still in its infancy. And yet, the WEB has clearly demonstrated tremendous potential for exciting, engaging and preparing a significantly larger and more diverse HPC workforce among current and future generations. The HPC educational portal developed by the HiPOP partners is both timely and uniquely positioned for directly contributing to and realizing this potential internationally.

The following are key policy recommendations for *exciting, engaging and empowering a significantly larger and more diverse HPC workforce.*

1. There is urgent need to collect and disseminate lessons learned, best practices, and quality reviewed materials from prior and current education, outreach and training initiatives on a global scale. These resources will allow the international community to build upon what has been learned to further advance HPC knowledge and scholarly education and research.
2. Developing a larger and more diverse HPC workforce is a global issue that can best benefit from international collaboration. The issues are in general very similar across countries and across continents. HiPOP has demonstrated that there is a great deal to be learned from one another. Every effort should be made to encourage and support international cooperation to significantly expand the workforce.
3. The greatest benefits can be achieved by working with a range of students spanning middle school through the graduate level. Research shows that students begin to lose interest in science and mathematics at the middle school level, and the pipeline continues to shrink in each subsequent year of their education.
4. To effect large-scale change, current and future teachers must be well prepared to immerse their middle and high school students in CS&E for the long-term advancement of science, technology, engineering and mathematics (STEM). There is urgent need for creating and providing suitable materials for these teachers to better illustrate/demonstrate the potential of models, simulations, and visualizations for motivating significantly more students to pursue STEM education and careers.
5. We need to both achieve and sustain large-scale preparation of students from middle school through their graduate education. We can accomplish this by adopting a vertical approach to education that provides a systematic learning continuum through collaborations among K-12 schools, colleges, CS&E experts, and business and industry. Through the HiPOP survey among professionals, we recognize that there is a broad enough base of organizations and experts willing to participate in large-scale endeavors. Collaborations such as these can be directly enhanced through better tools to enable and enhance these capabilities. Further,

these types of tools need to be incorporated into the educational framework to support K-lifelong learning systems.

6. No nation can fully realize its potential if a significant portion of its population is precluded from full participation in the use of advanced technologies including access to computational science and engineering tools and resources. Every effort must be made to engage under-represented communities including women, minorities, and people with disabilities. These under-represented communities also include fields of study that have not traditionally been involved in CS&E and HPC such as humanities and social sciences. There are numerous examples from among these communities that are now realizing the benefits of CS&E and HPC to advance their education and research.
7. Every effort should be made to interact with young researchers, at graduate and postdoc levels, to breed new ideas for a better appeal of CS&E to the youth and to induce CS&E community formation. This will entail understanding what excites and engages them through multi-media interactive WEB technologies, which are already prevalent in their daily lives, and expected to catch their attention.
8. Every effort should be made to provide students with a sense of long-term career opportunities available to them if they pursue advanced CS&E and HPC studies and then careers.
9. The increased utilization of Social Networking opportunities will help to attract today's students and foster collaborations and innovations. These approaches need to be studied to understand and further improve upon these innovative collaborative environments for engaging today's youth.
10. Every effort should be made to address and support global communities. This should include support for multiple languages and diverse cultural perspectives.

Academia, business and industry, government and non-profit organizations must collaborate to pursue these recommendations. Alone, these organizations will effect incremental change. In collaboration, they can realize large-scale transformational change for long-term impact and benefit.