

6. Summary Recommendations

This section summarizes the report's most important recommendations. The recommendations cut across the two clusters of strategies and opportunities. Taken together, these recommendations provide an initial strategy and steps for NSF to take in creating a cyberlearning infrastructure and initiating some powerful examples of how cyberlearning can transform systems to support education and learning. We believe that the climate is right in Washington and around the Nation for an aggressive and innovative program in cyberlearning. These five categories of recommendations complement work already going on in NSF and could serve as the basis for a significant initiative in the 2010 NSF budget. They also echo the major themes called out in the discussion above.

6.1 Help Build a Vibrant Cyberlearning Field by Promoting Cross-Disciplinary Communities of Cyberlearning Researchers and Practitioners

- Fund centers to use ICT to develop community-wide cyberlearning resources such as authoring environments, curriculum materials, professional development models, and assessments along with complementary talents needed for cyberlearning, e.g., researchers, classroom teachers, software designers, and school leaders.
- Establish funding of new summer training workshops and courses of study, integrative graduate education and research traineeships, postdoctoral fellowships, and research experiences for undergraduates devoted to building the cyberlearning capacities of the field. Recruiting and nurturing talent for research and teaching in these ways will ensure the diversity and breadth of the cyberlearning field. Industry and private foundation cosponsorships of such activities would be well warranted.
- Require cyberlearning projects to collaborate with teachers to create materials that build on their expertise and to test

innovations in varied settings.

- Support cyberlearning initiatives in professional development for in-service and preservice K–12 teachers. These programs need to be sustained over a minimum of 5 years to allow sufficient time for a cadre of well-trained and confident educators to become the role models and leaders.
- Utilize professional societies as an integral component of professional development because these organizations offer a cost-effective approach for reaching networks of committed educators (e.g., National Council of Teachers of Mathematics, National Science Teachers Association, National Society of Black Engineers, Association for Computing Machinery, Institute of Electrical and Electronics Engineers, International Society of the Learning Sciences).
- Launch a program that brings together technologists, educators, domain scientists, and social scientists to coordinate and draw upon repositories of cyberlearning data to advance our understanding of human performance.
- Publish a set of best practices for cyberlearning together with results from trials in diverse settings and recommendations about steps necessary for successful implementation.

6.2 Instill a Platform Perspective Into NSF's Cyberlearning Activities

- Fund the design and development of a common, open cyberlearning platform that supports a full range of teaching and learning activities, including assessment and analysis.
- Convene a panel of experts to delineate the requirements for such a platform and recommend possible hardware and software architectures.
- Require new technology projects to contribute interoperable components to the open platform rather than develop in isolation.

- Arrange for promising innovations to be utilized for the design of high-value resources that will be deployed on the platform for impact of nationwide scope.
- Maintain a tested collection of learning modules on the platform that teachers can easily integrate into their practice.
- Design effective supports for those using these modules to incorporate them into a full curriculum, customize them for specific goals, author new materials that incorporate effective pedagogy, align assessment with instruction, and create professional development that takes advantage of the same technologies.
- Establish a small office to monitor the growth and health of this infrastructure and to propose strategies to improve its health.
- Empanel reviews of the NSDL and the ITEST programs, with a charge that includes consideration of the future of the programs in light of recent developments in cyberinfrastructure broadly.

6.3 Emphasize the Transformative Power of ICT for Learning, From K to Gray

- Fund programs that tap the educational potential of the vast new flows of scientific data on the Web.
- Mount a program to stimulate the development of remote and virtual laboratories, including interactive simulations, and use of sensor networks and probeware as national resources, and to explore effective ways to design, deliver, and support this type of instruction.
- Fund research that highlights the educational use of information tools that operate seamlessly across formal and informal learning environments and across traditional computers, mobile devices, and newly emerging information and communications platforms. Assess ethical practices in the use of scientific data and of learner data in

cyberlearning by convening or coconvening a workshop.

- Fund foundational studies that restructure STEM knowledge domains using the interactive, representational, and data-mining capabilities of the cyberinfrastructure.
- Accelerate the development of the cyberlearning field by establishing synergistic partnerships with companies that are pioneering advances to the cyberinfrastructure and other foundations (e.g., Gates, Hewlett, Kaufmann, MacArthur, Mellon) and Government agencies that are funding related initiatives and programs.

6.4 Adopt Programs and Policies to Promote Open Educational Resources

- Require NSF grant proposals to include clear intellectual property statements about the deployment of educational materials funded by NSF.
- Require all educational materials produced with NSF funding to be made available on the Web using one of the family of Creative Commons licenses, to facilitate automated searching and processing and permit unrestricted reuse and recombination.
- Require grant proposals to contain a section that carefully considers strategies for the sustainability of the education materials funded by NSF.
- Have NSF launch a program to demonstrate sustainable models for providing open educational resources.

6.5 Take Responsibility for Sustaining NSF-Sponsored Cyberlearning Innovations

- Institute processes and mechanisms for sustaining innovations so that educational materials developed by grantees will continue to have impact long after NSF support has ended.
- Implement effective handoff and partnership programs so that valuable innovations remain in use and can be built upon. These programs should consider the role of industry, professional organizations, and other potential contributors.
- Coordinate cyberlearning activities across all of the NSF divisions to ensure that cross-fertilization—rather than duplication—of efforts occurs.
- Empower a Blue Ribbon Panel to oversee these activities by convening a standing panel of experts from across sectors and charging them with the responsibility to define, explore, and take responsibility for maintaining the aforementioned cross-sector partnerships for cyberlearning. Potential models to consider include the following:
 - The National Academy of Sciences Government–University–Industry Research Roundtable,²⁷ with a mission “to convene senior-most representatives from Government, universities, and industry to define and explore critical issues related to the national and global science and technology agenda that are of shared interest; to frame the next critical question stemming from current debate and analysis; and to incubate activities of ongoing value to the stakeholders.”
 - The Roundtable on Science and Technology for Sustainability,²⁸ which includes “senior decisionmakers from the

U.S. Government, industry, academia, and nonprofit organizations who are in a position to play a strong role in promoting sustainability.” Their goal “is to mobilize, encourage, and use scientific knowledge and technology to help achieve sustainability goals and to support the implementation of sustainability practices.”

Other recommended participants and related organizations include the following:

- The Learning Federation,²⁹ which is a partnership joining companies, universities, Government agencies, and private foundations to promote a national research plan to create radically improved approaches to teaching and learning enabled by information technology
- Educause,³⁰ which is a nonprofit association whose mission is to advance higher education by promoting the intelligent use of information technology
- MacArthur Networks,³¹ which are interdisciplinary research networks, “research institutions without walls,” addressing a variety of topics
- The MacArthur Foundation’s Digital Media and Learning³² effort to fund research and innovative projects focused on understanding the impact of the widespread use of digital media on our youth and how they learn

As we realize new models for collaboration, the new organizations need to be chartered and empowered to execute their mandates—namely, the sustainability of learning technology innovations and solutions needs to be an ongoing priority. Once sustainability is achieved, it is then important to ensure the careful transition from startup to maintenance mode, ensuring a handshake instead of a handoff.

²⁷ <http://www7.nationalacademies.org/guir/>

²⁸ <http://sustainability.nationalacademies.org/roundtable.shtml>

²⁹ <http://www.learningfederation.org/>

³⁰ <http://www.educause.edu/about/>

³¹ http://www.macfound.org/site/c.1kLXJ8MQK/H/b.948165/k.E3C/Domestic_Grantmaking___Research_Networks.htm

³² <http://digitallearning.macfound.org/site/c.enJLKQNFIG/b.2029199/k.BFC9/Home.htm>