



UNAVCO Response to “Cyber Infrastructure in Support of Geoscience Education”

Summary

- The 2004 NSF-supported workshop report “Geoscience Education and Cyberinfrastructure” contains an accurate summary and representation from the geoscience education community regarding issues and questions in the Dear Colleague Letter.
- The geoscience community and the NSF Geoscience Directorate should recognize and use the lessons learned from DLESE and NSDL during the past 4-5 years and build upon these successes.
- Research facilities and projects such as UNAVCO and EarthScope depend on projects such as GEON, DLESE, NSDL, and others to provide the bridge to educational audiences in order to make our science relevant and serve the needs of our researchers and the broader community.

Introduction

We are responding to the ‘Dear Colleague Letter’ (DCL) of November 30, 2005 regarding the future characteristics of cyber infrastructure in support of geoscience education. UNAVCO is engaged in this process by means of supporting research using a highly sophisticated infrastructure of global data collection and transmittal to our archive, developing portals using new tools for data access to the broad community, and building an educational program to broaden participation in this infrastructure. UNAVCO partners with other projects and organizations such as EarthScope, GEON, DLESE, IRIS, SCEC, and individual principal investigators and other researchers in geoscience, education, and technology.

Many of the questions addressed in the DCL are answered in the 2004 NSF-supported workshop and report, “Geoscience Education and Cyberinfrastructure”. As a participating organization in that workshop, we feel that the report is an accurate summary and representation of the ideas of the more than 50 participants who represented a variety of roles in geoscience education.

Although the goals outlined in the cyberinfrastructure report are broad, there are specific recommendations within the report that addresses the cyberinfrastructure issue on a more systemic scale than some of the questions and examples presented in the DCL. The geoscience community and the Geoscience Directorate at NSF should take note and commend themselves that many of the questions addressed in the DCL have been addressed by a broad set of users during the past few years within the NSDL and DLESE communities. For example, the basic services and architectures are all currently provided by DLESE and questions of collections, search engines, etc. are not new ones but have extensive reports and data supporting some of our current models. We urge NSF not to dismiss or discard the intellectual property that has been developed over the past 4 years.

Cyberinfrastructure and Education from UNAVCO's perspective

UNAVCO currently has a three pronged involvement with cyberinfrastructure: the use of technology in collecting, storing, and disseminating data from our community, participation in GEON*, and a program of education and outreach that provides tools and an educational framework to acquire, understand, and use data for both research and education. The discussion below is based on UNAVCO's experience in these three arenas.

**The goal of GEON is to advance the field of geoinformatics to prepare and train current and future generations of geoscience researchers, educators, and practitioners in the use of cyberinfrastructure to further their research, education, and professional goals. GEON supports "intelligent" search, semantic data integration, visualization of 4D scientific datasets, and access to high performance computing platforms for data analysis and model execution*

The Technology

Cyberinfrastructure (CI) makes it easy to access huge quantities of data, provides powerful analysis tools, but needs to be accompanied by supportive material that help the users understand the concepts and make meaningful conclusions from vast amounts of data. Our community must learn to teach the concepts of our science in the CI environment. How people learn must be incorporated into the design and dissemination of new and existing tools. The current Digital Library has the technology to serve the community. What we need are quality resources and a continuation in building community.

The People

It is extremely important that geoscientists work with experts in other fields who are addressing similar issues and uses, especially those whose primary research interest is in cyberinfrastructure. These types of partnerships must include the researchers who are providing the basic data for our science; researchers in fields such as computer science, informational technology, educational technology, and cognitive science on how people learn from technology.

NSF must ensure that development needs match those of the end users from researchers through the K-12 community, to the general public. As the country's demographics change, it is also NSF's responsibility to ensure that cyberinfrastructure is not the property of the country's elite. Cyberinfrastructure development should be aligned with cutting edge, basic scientific, technological, and education research but should not lose sight of political and social demands on our educational system as a whole, e.g. "No Child Left Behind".

Cyberinfrastructure (CI) cannot be developed without investment in education and training so that users can take advantage of new developments. This should occur at all levels. Geoscientists training in our formal educational programs should have a broad education which includes understanding and using the tools to succeed in a world of technology. In addition, CI offers an opportunity to attract a new group of people who are interesting in using technology in solving Earth science problems.

For a robust workforce of people contributing to geoscience and education cyberinfrastructure, we must have full participation. For this to occur, our system of rewards must change to account for contributions and reviews in this new digital, web-based environment. NSF could be a driving force to develop a cultural change to acknowledge scholarly contributions to CI environment along with professional credit in promotion, tenure, and performance reviews.

And last, people must come together to forge partnerships, exchange knowledge, and learn how to work collaboratively in a cyberinfrastructure environment. This was strongly acknowledged in the 2004 report, and it is true in any discipline or endeavor. People still need to see and talk to other people and we must learn which real and virtual environments are best to promote people working together in our new environments. The community building of DLESE through annual meetings and workshops is a unique and significant service to geoscience education.

Structure, Service, and Management

As mentioned in the introduction, our community has made great strides in the last few years. Projects such as GEON, DLESE, and NSDL have been pioneers in thinking about these issues, and, at the least, have developed prototypes of services for our community. Despite recent criticisms of DLESE, particularly its management structure, much good has come of this initial experiment. We have rigorous systems of metadata. We understand that holding collections of dynamic digital resources is not viable as most of our tools and web-based resources are dynamic works. We know what does and not work in community reviewing digital resources. The value of services like DLESE is to help people navigate through the CI environment and to discover useful resources. DLESE has provided leadership in best practices in developing curricular materials using the web for development and dissemination and the Community Data groups have been leaders in educating our community in these practices and uses.

Development of using cyberinfrastructure in geoscience education must have both leadership and management. Leaders are those people who see the big picture and can foresee where disciplines are doing. We must also set up rigorous evaluation standards and procedures to ensure that our resources are well spent and that this work serves the needs of our broad geoscience community.

Conclusion

UNAVCO will continue to embrace new technologies in the study of crustal deformation e.g. InSAR, land-based LIDAR and new developments in GPS. Research facilities and projects such as UNAVCO and EarthScope depend on projects such as GEON, DLESE, NSDL, and others to provide the bridge to educational audiences in order to make our science relevant and serve the needs of our researchers and the broader community.

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