Cyberinfrastructure and Geoscience Education

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CI and Geo-Ed Workshop

• April 2004
• Seek broad representation of the geoscience education community
• Begin the process for integrating CI planning for geo-education into the larger planning processes for geosciences and environmental sciences
• Seek broadest possible dissemination of findings and recommendations
Attendees

- 50 K-16 geoscience educators, research scientists, informal science educators, computer scientists, students, instructional designers
Approach

• Workshop structured around 4 key issues:
  – What is the vision for geoscience education and cyberinfrastructure?
  – What are the steps to achieving that vision?
  – How can the geoscience community integrate cyberinfrastructure to transform teaching and learning processes?
  – How can the needs and desires of geoscience education inform cyberinfrastructure development and impact?
“Human resource issues should be given top priority in CI development and investment. The academic reward structure should recognize CI-related activities, and NSF should seek additional ways to support investments in CI personnel at all levels, including departments, campuses and centers.”

Ad Hoc Committee for Cyberinfrastructure Research, Development and Education in the Atmospheric Sciences (CyRDAS)
Outcomes: Vision Statement

- … a geoscience education cyberinfrastructure that will dramatically transform the landscape of teaching and learning for all.
  - Will promote the recognition and understanding of the connections, interactions, and relationships among local and global phenomena in the Earth system.
  - Will support innovative strategies for inquiry-based, collaborative learning in both formal and informal settings.
  - Will enable free and open access to valuable geoscience content, services, and expertise that excite a passion for the pursuit of geoscience careers, and promote a scientifically literate citizenry.
Outcomes: Key Values

- Promoting stewardship of the Earth
- Building a broad-based scientifically- and technically-literate society
- Integrating education as a high-priority in CI projects
- Supporting human-to-human communication and collaboration
- Providing open access to educational and scientific content and data, tools, and services
Recommendations based on the key values

- Form working group of educational outreach staff from existing funded CI efforts – to identify issues and solutions to the immediate challenges of integrating geoscience education into large CI projects.

- Undertake concerted effort to document, measure, and understand the impact of CI on geoscience education.
Recommendations based on the key values

• Encourage submitters to CI programs to clearly relate their proposed educational activities and evaluations to the goals outlined in this report.

• Ensure that data from CI projects and centers are available for **broad dissemination**, in partnership with recognized data archives and digital libraries, such as DLESE and NSDL.
Outcomes: Goals

- Collaborate and build new social structures
- Support ubiquitous learning environments
- Maximize a computational approach to geoscience
- Create dynamic models of student understanding
- Develop smart tools for authentic learning
- Expand educator professional development
Goal 1 Recommendations: Collaborate and build new social structures

- Develop a portfolio of CI projects designed to teach and develop collaboration and communication skills from an early age, and embed these skills throughout all stages of formal and informal learning.

- Ground proposed technical advances in collaboration and communication technologies in theoretical and/or empirical understandings of effective communication, collaboration, and teamwork.
Goal 1 Recommendations: Collaborate and build new social structures

• Proposed technical advances in collaboration and communication technologies should provide educator training on the effective use of technologies within educational settings.

• Strengthen individual projects by collaboration that supports mentoring and scaffolding among researchers, educators, and learners, and provides a clear structure for evaluating these efforts.
Goal 2 Recommendations: Support ubiquitous learning environments

- Support CI projects that investigate creating and evaluating informal and ubiquitous science learning environments, with an emphasis on developing design principles for 24/7 learning.

- Projects should address lifelong learning or citizen science components, i.e., investigating how CI can positively influence the way we live, govern, and recreate.
Goal 3 Recommendations: Maximize a computational approach

- Support CI projects that use computational geoscience approaches to develop age-appropriate tools and services for learners, and supporting educational materials that facilitate integration into the curriculum.

- CI should support projects that help learners and future geoscientists develop advanced computer science skills required for geoscience study and application.
Goal 4 Recommendations: Create dynamic models of student understanding

- Encourage projects to contribute to:
  - **Basic research in human protocols of learning, interaction, and communication** through partnerships with researchers in these disciplines
  - **Basic knowledge** that will **advance theories of learning**, particularly types of cognition and skills important to geoscience (spatial thinking, data analysis, etc.)

- Encourage projects to address how **learners of all ages acquire and evolve geoscience concepts over time**.
Goal 5 Recommendations: Develop smart tools for authentic learning

- Projects should offer **field research opportunities to K-16 teachers/learners**, where they can learn and use **advanced tools for data collection/analysis**, and should incorporate mechanisms for sharing information, collaborating with teachers and learners, and discussing outcomes **into tools and repositories**.
Goal 6 Recommendations: Expand educator professional development

• CI should support the development of educational methods, courses, and teacher certification programs that incorporate current scientific data, tools, and analytical techniques.

• Encourage projects that support educational standards, and that link the issues surrounding high stakes testing, teacher professional development opportunities, and learner achievement.

• Establish a formal distributed network to coordinate these efforts.