A Need for an Education and Outreach Component of EarthCube

2011-10-17

EarthCube represents a novel and exciting collaboration among the Geoscience and Cyberinfrastructure communities. We believe EarthCube needs a vigorous Education and Outreach component incorporated from the start. The EarthCube goal "to create a knowledge management system and infrastructure that integrates all geosciences data in an open, transparent and inclusive manner" implies and requires sharing that knowledge through education and outreach. The EarthCube website intends to "provide updated information, resource documents, and discussion forums so that community groups, consortia, researchers, and educators can share ideas, introduce concepts, and find and develop collaborative efforts.", but an education 'voice' has, as far as we can tell, not yet emerged. In this short paper, we attempt to add the education and outreach voice.

1) Many of us work with or for organizations that link research and education (e.g. UNAVCO: "facilitates geoscience research and education through geodesy"). This linkage occurs clearly and repeatedly in NSF and NSF GEO documents: " The Directorate for Geosciences (GEO) recognizes that active support of geoscience education and workforce development must be a significant element of GEO's mission .... This commitment extends beyond ... training of graduate students to embrace geoscience education reform at the undergraduate and pre-college levels and active outreach to the public." The ESIP (Earth Science Information Partners) Federation espouses a similar message: "to make accessible and usable to educators and learners at all levels in both formal and informal educational contexts .. Earth science data, knowledge, tools, and educational materials". Integrated research and education missions across geoscience share an urgent need for efficiently managed and easily accessible data and data products.

2) EarthCube will clearly enhance access to data for a wide range of geoscience researchers. However, new products, particularly new technological services, need accompanying user education and product outreach to succeed. In science as in the world of commercial products, creating a need and an acceptance of new services becomes as important as the technical innovations of the products themselves. EarthCube will need an effective outreach strategy to present and future users.

3) In many ways, educators provide a higher standard of accessibility, reliability and usability for research data than the original generators of research data themselves. Researchers may download data sets, reformat them as necessary, and process those data using favored scientific analysis and visualization tools, but educators require more: quick easy and access in a friendly and understandable format, through reliable and simple tools. Reliability in this sense includes not only reliable performance but also persistence from semester to semester or year to year. For the most part, the education tools need to involve publicly accessible services (browsers and apps) running on everyday platforms. Incorporating these educational

requirements into the EarthCube designs at an early stage will improve the services to educators and to a wider array of researchers.

4) EarthCube will deal extensively with metadata. Thinking beyond researchers to educators broadens the definitions and expands the concepts of metadata. Although several geoscience data services acknowledge educational use as an element of their research metadata standards, educators need education-focused metadata that expose the full range of educational uses in order to design curriculum materials or student activities around the data (Ledley et al 2008).

5) Researchers presently exchange information and products person-to-person and through specialized trading systems. Outside of those specialized networks, and for a much larger potential audience of educators and the public, EarthCube needs to include geo-referenced digital clearinghouses of images and digital products. EarthCube discussions often focus on access to data / data portals. For education and outreach, it is equally important to have access to end user products, images or other graphical interpretations derived from raw data, and models based on the data. The urgent and necessary drive for equal-access data portals must include stronger recognition of a broader community of end users of digital information.

6) Educators already work at the forefront of many elements of information infrastructure, using digital textbooks, on-line course materials, interactive activities, on-line testing, etc. A geology teacher in a high-school or 2-year college perceives and has very likely mastered a completely different set of data (broadly-defined) infrastructure than a researcher. This education-based viewpoint can add extreme value to research data and research databases, value that impacts not only the educators but a broader range of researchers as well.

7) The EarthCube project will benefit from an outreach strategy, within geoscience and to a larger scientific and public audience. Even as it explores deep and difficult data issues, it can convey positive messages of enthusiasm, exploration and creativity to other scientists and to the public. In addition, a focused EarthCube outreach strategy will help to keep educational media abreast of current, cutting edge research methods and results.

This short paper condenses to two fundamental recommendations. First, incorporating educational requirements at an early stage will push the EarthCube design discussions to address a broader range of issues and to develop solutions with a broader range of impact for research as well as education. Second, outreach from the start will improve the eventual adoption of the solutions within geoscience, and publicize the EarthCube effort to the larger science community and to the public.

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Resources

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