Our Cosmic History as a Meaningful Context for Education
Todd Duncan, Center for Science Education, Portland State University, March 2009

Background

An important function of education is to teach detailed knowledge and proficiency in specific skills. For this purpose, narrow focus and compartmentalization can be effective. But another important function of education is the development of wisdom—the ability to use knowledge in a reflective, integrative way to guide how one lives. For this purpose a big picture, interdisciplinary view is important. Such a big picture perspective is also valuable for providing motivation and a contextual framework that gives meaning to the learning of detailed knowledge and skills.

Despite (perhaps partly because of) its recent rapid advances, science in particular has struggled with the transition from fragmented knowledge to integrated wisdom. A representative comment expressing this concern is from an AAAS report, The Liberal Art of Science: “Science has not been integrated adequately into the totality of human experience.” More sharply stated, writer Bryan Appleyard has commented that “On the maps provided by science, we find everything except ourselves” (Understanding the Present: Science and the Soul of Modern Man). More recently, physicist Brian Greene emphasized the need for big picture context in science education:

“But science is so much more than its technical details. And with careful attention to presentation, cutting-edge insights and discoveries can be clearly and faithfully communicated to students independent of those details; in fact, those insights and discoveries are precisely the ones that can drive a young student to want to learn the details. We rob science education of life when we focus solely on results and seek to train students to solve problems and recite facts without a commensurate emphasis on transporting them out beyond the stars.”

— Brian Greene  (NYT Op Ed, June 1, 2008)

Though science in particular suffers from this fragmentation and narrowing of perspective, really all disciplines struggle to maintain a big picture perspective which provides context and organization for the rapidly growing volume of specialized knowledge. This compartmentalization becomes more dangerous as our specialized knowledge gives us greater power to influence our environment. As information technology expert James Martin expresses by analogy, “We have vast numbers of experts on how to make the train work better and faster, but almost nobody is concerned with where the train is heading or whether we’ll like its destination.”

It's commonly said that we can't know where we're going without knowing where we've been. The need for a big-picture perspective on who we are, where we came from, and where we're going is perhaps more important now than ever, as we make decisions that affect the fate of our species and our planet. But this broad perspective is difficult to achieve, particularly within the formal educational system. As historian David Christian writes in Maps of Time, “…from schools to universities to research institutes, we teach
about origins in disconnected fragments. We seem incapable of offering a unified account of how things came to be the way they are.”

Summary of the Problem

Keeping that background in mind, the problem we want to address with this proposal has two core elements:

1) The fragmentation of knowledge and the common lack of context/motivation (particularly for science) in our educational system. There’s no clear place for big picture, interdisciplinary wisdom to be developed intentionally as part of the curriculum.

2) The need for a contextual framework that can be accessed in flexible ways, from a variety of directions/levels and serving a variety of needs (K-12 students, K-12 teachers at different grade levels, various curricula in different states and countries, college teachers and students, public at various stages of education, etc.)

Cosmic History – A Contextual Framework to Help Address These Issues

As one solution to this fragmentation problem, there's growing interest in using the scientific and historical story of human origins (from the “big bang” to the present) as an interdisciplinary framework for education at various levels, including K-12 curriculum, university general education, public education, and to support social change in the direction of a sustainable society (see e.g. references to Chaisson, Christian, Duncan, Evolutionary Epic, Grassie, Greene, Spier, etc. -- examples of efforts to set up this sort of curriculum are underway). This story, which I’ll refer to as “our cosmic history” (similar to what is often called "big history" or the "evolutionary epic"), provides a coherent structure for giving meaning, perspective, and relevance to what can otherwise be disjointed topics. It’s a way to combat the sense of apathy toward science and the feeling among many students that science is irrelevant to their lives. But much more than that, it offers a way to integrate knowledge from all disciplines into a coherent story that provides a sense of orientation for the “whole person” within our modern understanding of the universe.

The central objective of this project is to provide solid and sustainable access to such a context, the overarching story of our cosmic history.

An important aspect of this proposal is an emphasis on providing flexible access to this motivating context. It should link to and complement curriculum development and educational standards, but also needs to exist and operate outside of these constraints, according to its own internal logic as a story of our human history. It should provide pathways for people to access its structure and lessons from nearly any starting point: an interested layperson with little science background, teachers at various grade levels and types of schools wanting an overarching context to motivate some of their lessons, university science students wanting to see how their specialized studies fit within the big
picture, etc. The purpose of this project is not to teach all of the science content that everyone should know, but rather to offer a conceptual map in which students can orient themselves and place the detailed knowledge they learn and see how it all fits together in a meaningful big picture. (Though of course this program will teach some specific content in the process of providing this big-picture context.)

The core of the program will be a course called “Our Cosmic History,” designed to give an overview of the scientific story of our human origins, from the beginning of the universe to our present technological society. This theme provides a way to organize a wide variety of scientific disciplines into a coherent story of deep human interest - our own origins. The common thread throughout the story is the emergence of structures of increasing complexity driven by the flow of energy - a story of interaction, change, and emergence. The course will be open to the public, targeting K-12 teachers and students as a way to provide a coherent contextual framework for the science they learn in regular classes, continuing education credit available for teachers and others who wish it, etc. The course will be taught by Todd Duncan (physics/science education background) in collaboration with Doug McCarty (philosophy/astronomy education), and Barbara Traver (world history), based on a synthesis of the 2008-9 “Our Cosmic History” lectures and related material from other sources.

Rich framework for related projects

The basic framework of our cosmic history provides a great platform for a variety of related projects that connect the framework to particular needs. I’m picturing the core course and supporting materials (a video version of the course produced by Scott Hacke’s group) as the highlights of a broad framework that teachers and students can tap into as a meaningful background context for a wide variety of topics and lessons, in settings we cannot anticipate. So there are many opportunities for building more detailed materials around this framework - it's a skeleton which can be fleshed out in greater levels of detail with curriculum for different grade levels, etc. A few ideas:

- Developing teacher guides and supporting curricula to help teachers connect their lessons to the cosmic history framework in a variety of settings (different grade levels, new science standards, private schools and home schooling, etc.)
- recording lectures and making them available to a much wider community (Scott Hacke and Jay Allen are demonstrating the possibilities here by filming some of this year's lectures). These could just be a recorded version of the course we offer in person, or could be a separate project, building on the same theme and perhaps using clips from lectures and classes, but designed specifically for broadcast in various settings, activities designed for this purpose, etc.
- Context for thinking about sustainability as a "virtue" - our cosmic history offers a broader context on which that virtue could be founded and understood
- Assessment - how can one assess the development of "wisdom" or "change in perspective," which presents very different challenges than measuring gains in specialized content knowledge? This framework could be a case study opportunity for someone who wanted to explore and develop that type of learning assessment.
- Ways of involving students in telling the story of our cosmic history through theatre, dance, and music (Pauline Le Bel has experience with this, see also the work being done by Chris Impey and others in connection with the search for extrasolar planets and life)  
  - Etc. - feel free to brainstorm other ways that your work might connect to a cosmic history framework

** People **

** [I’ve just started jotting down notes on the background we all bring to this... if you’re interested, feel free to add/edit your name and info to expand this]

Todd Duncan (Science Integration Institute, PSU CSE, Dept. of Physics, Pacific University) - main research is exploring the nature of ultimate reality and how humans fit in with that, so directly engaged in the big questions. Experience bringing them to right level for education - SII work, high school senior inq. using big questions to motivate “wow, this is science” response, as brian greene highlights

Doug McCarty - Planetarium Director and Astronomy Instructor, Mt. Hood C.C., philosophy and astronomy background, PSU CSE MST student, etc.

Barbara Traver - Former WV HS faculty, ABD PhD student in world history at WSU, experience with interdisciplinary teaching in Sr. Inq., etc.

Jay Allen, Scott Hacke - video production, interest in bringing more exciting science to the community, etc.

David Christian - pioneer of the “big history” theme, 20 years + experience with big history curriculum, book Maps of Time, articles on big history, lectures, etc.

** References **

Todd’s paper for Evolutionary Epic Conference 2008 and Wisdom proposal for Arete Initiative/Templeton

Description of current Our Cosmic History Series on OTS site - http://oregonteachersscholars.pbwiki.com/OurCosmicHistory

Greene, Brian, Op Ed NYT June 1 2008, Put a Little Science in Your Life

Duncan, An Ordinary World: The role of science in your search for personal meaning

Duncan and Tyler, Your Cosmic Context: An Introduction to Modern Cosmology

Christian, David: Maps of Time; outline of curriculum proposal for australian schools,

   This Fleeting World, other papers and powerpoint files

Spiers, Fred - web site, books, etc.

McNeil, The Human Web (bird’s eye view of history)

Brown, Cynthia, Big History

Chaisson, Eric - several books, articles, and web site

Morowitz, Harold, The Emergence of Everything
Grassie, William, Teaching the History of Nature
   (http://www.metanexus.net/magazine/tabid/68/id/10326/Default.aspx)
Martin, James, The Meaning of the 21st Century (on wisdom, pp. 235-6)
AAAS report The Liberal Art of Science
Weislogel, Eric, The Transdisciplinary Imperative
   (http://www.metanexus.net/magazine/tabid/68/id/10669/Default.aspx)

**Funding Needs and Opportunities**

- important to be careful here - keep separate from details of any particular curriculum so can follow its own internal logic, but be accessible for needs of different curricula, providing a meaningful framework for them to plug into and draw from
- Oregon Dept. of Ed MSP program
- could weave this into Templeton grant
- Intel foundation, Gates foundation (David’s connection with Bill Gates?), etc
- selling books and curriculum materials
- Individual donors, especially those who have attended free lectures over the past few years; fundraising specifically for this purpose