

Science Literacy: What is it? How is it achieved?

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Tonight's Session

- Brief overview of Project 2061
- Need for Science Literacy
- Evidence for rethinking science education (video)
- Project 2061 Reform Tools
 - *Science for All Americans*
 - *Benchmarks for Science Literacy*
 - *Designs for Science Literacy*
 - *Atlas for Science Literacy*

What can today's educators do to help students achieve science literacy?

Is There a Need for Change?

**Think about your own
science education...**

**What is one science
concept/idea that you
learned?**

**What is one that you've
never quite understood?**

Implementing Standards-Based Education: What will it take?

“It is now widely accepted that in order to realize recently proposed reforms in what is taught and how it is taught in mathematics and science (NCTM, 1989, 1991; Rutherford and Ahlgren, 1989 {*Benchmarks for Science Literacy*, 1993}; and NRC, 1996)

**teachers will have to unlearn
much of what they believe,
know, and know how to do...
(Ball, 1998)**

**while also forming new beliefs,
developing new knowledge,
and mastering new skills.”**

**From “The Frame and Tapestry” Thompson and Zeuli,
*Standards-Based Reform and Professional
Development*, 1999**

Characteristics of Project 2061

Literacy in
science, math,
and technology

**ALL
Americans**

K-12

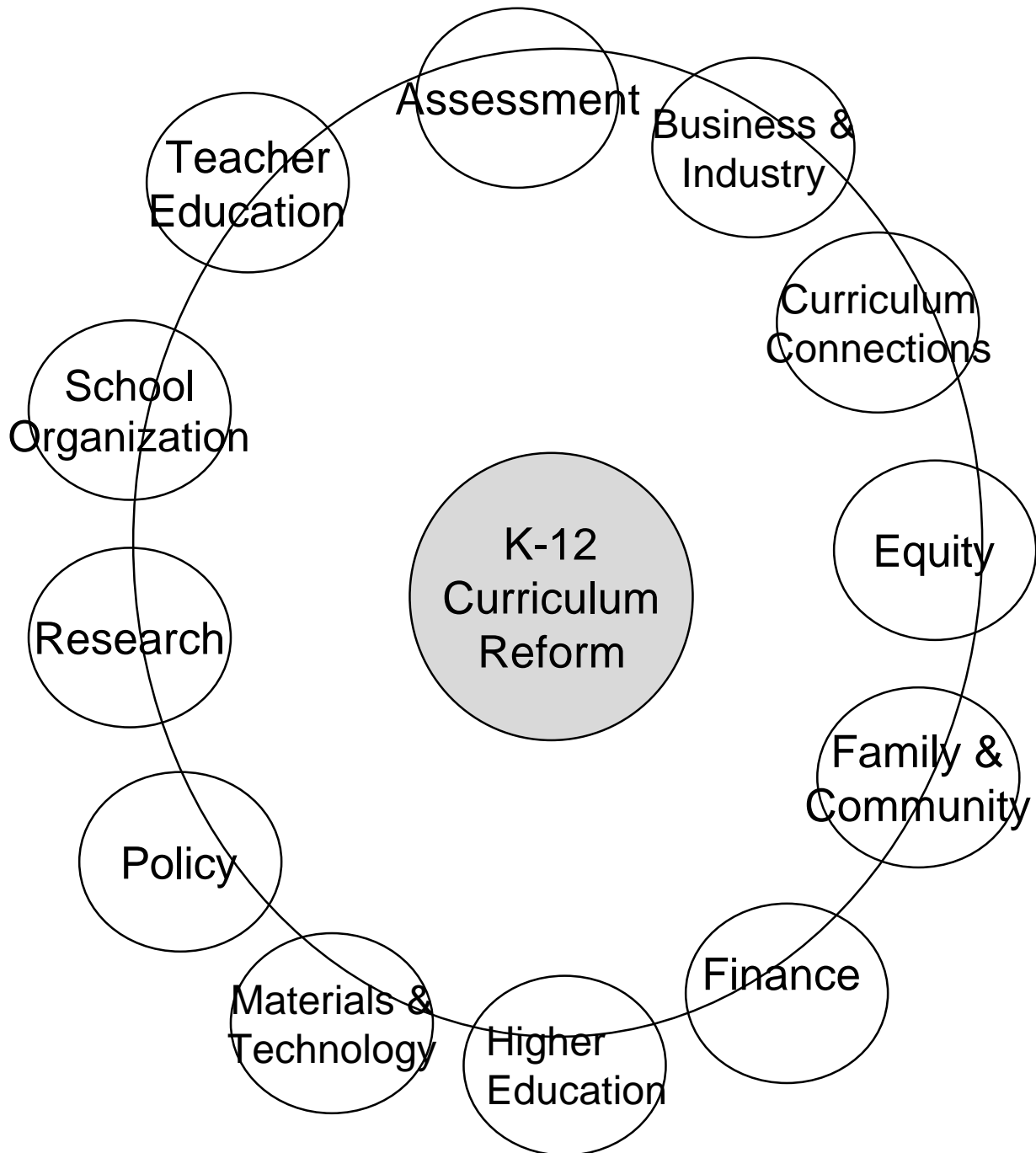
Project 2061

**goal
oriented**

less is better

**Long-
term**

Reforming the Education System



Let's look at some students' knowledge...

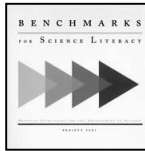
How would students answer the following question:

Where does the mass of a tree come from if it grows from such a tiny seed?

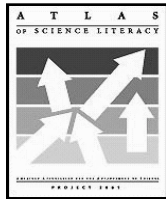
Project 2061 Tools



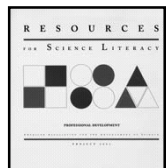
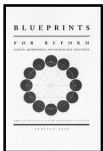
- ***Science for All Americans*** With expert panels of scientists, mathematicians, and technologists, Project 2061 set out to identify what was most important for the next generation to know and be able to do in science, mathematics, and technology—what would make them science literate. *Science for All Americans* defines science literacy and lays out some principles for effective learning and teaching.



- ***Benchmarks for Science Literacy*** Benchmarks lists what all students should know and be able to do in science, mathematics, and technology by the end of grades 2, 5, 8, and 12. The recommendations at each grade level suggest reasonable progress toward the adult science literacy goals laid out in *Science for All Americans*. *Benchmarks* can help educators decide what to include in (or exclude from) a core curriculum, when to teach it, and why.



- ***Atlas of Science Literacy*** *The Atlas of Science Literacy* has collection of 49 conceptual strand maps that show how students' understanding of the ideas and



Student's Growth of Understanding

The Project 2061 staff prepared this message to convey to the teams its concern with students' growth of understanding:

*If we invest our energies in selecting or inventing activities and pacing them intuitively at different grade levels, we will fall short of the quality of innovation that Project 2061 intends. The job is rather to **think through the entire flow of learning, including major connections among ideas**, so as to identify the kinds of learning experiences that would optimally contribute to students growing along those lines.*

***Atlas of Science Literacy*, p. 137**

Why is it important to think through the flow of learning before choosing or inventing different activities?

Criteria for Inclusion in SFAA

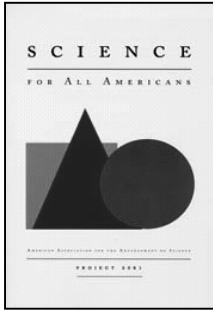
The criteria for identifying a common core of learning in science, mathematics, and technology were both scientific and educational. Consideration was given first to the **ideas that seemed to be of unusual scientific importance**, because there is simply too much knowledge for anyone to acquire in a lifetime, let alone 13 years. This meant favoring **content that has had great influence on what is worth knowing now and what will still be worth knowing decades hence**, and ruling out topics mainly of only passing technical interest or limited scientific scope. In particular, **concepts were chosen that could serve as a lasting foundation on which to build more knowledge over a lifetime**. The choices then had to meet important criteria having to do with human life and with the broad goals that justify universal public education in a free society.

The criteria were:

- Utility.** Will the proposed content—knowledge or skills—significantly enhance the graduate's long-term employment prospects? Will it be useful in making personal decisions?
- Social Responsibility.** Is the proposed content likely to help citizens participate intelligently in making social and political decisions on matters involving science and technology?
- The Intrinsic Value of Knowledge.** Does the proposed content present aspects of science, mathematics, and technology that are so important in human history or so pervasive in our culture that a general education would be incomplete without them?
- Philosophical Value.** Does the proposed content contribute to the ability of people to ponder the enduring questions of human meaning such as life and death, perception and reality, the individual good versus the collective welfare, certainty and doubt?
- Childhood Enrichment.** Will the proposed content enhance childhood (a time of life that is important in its own right and not solely for what it may lead to in later life)?

Science for All Americans, p. xix

Quotations



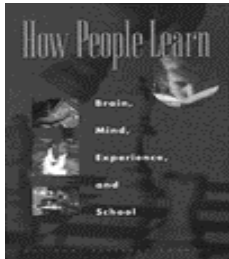
No linear presentation of topics can satisfactorily represent the connectedness of ideas and experiences that would be essential in an actual curriculum or textbook.

Science for All Americans, AAAS, page xxi



No single coherent vision of how to educate today's children dominates U.S. educational practice in either [mathematics or science], nor is there a single, commonly accepted place to turn to for such visions. Our visions—to the extent that they exist at all—are multiple. These splintered visions produce unfocused curricula and textbooks that fail to define clearly what is intended to be taught. They influence teachers to implement diffuse learning goals in their classrooms. They emphasize familiarity with many topics rather than concentrated attention on a few. And they likely lower the academic performance of students who spend years in such a learning environment. Our curricula, textbooks, and teaching are all “a mile wide and an inch deep.

Schmidt et al., 1996



Traditional curricula often fail to help students "learn their way around" a discipline. The curricula include the familiar scope and sequence charts that specify procedural objectives to be mastered by students at each grade: though an individual objective might be reasonable, it is not seen as part of a larger network. Yet it is the network, the connections among objectives, that is important.

*How People Learn, National Research Council,
page 139*



Unless educators understand how ideas and skills develop over time and how they relate to one another, students will be left with nothing more than a heap of unrelated, poorly understood, and quickly forgotten facts, algorithms, and technical terms.

Atlas of Science Literacy, AAAS, page 3

“Learning important ideas is challenging enough in any case...we owe it to students to think through very carefully the fabric of understanding we expect them to learn.”

Chick Ahlgren
Associate Director
Project 2061

Q & A

- Questions...
- Concerns...

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