



Using the Giant Timeline to Meet Science Education Standards

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National Science Education Standards

Content on the Giant Timeline can be used to illustrate many science standards established in: National Research Council, National Science Education Standards, National Academy Press, Washington DC, 2005.

Unifying Content Standards for all grades

Fundamental concept: Systems, order, and organization

Evolution and natural selection are great examples of fundamental order. The standards even specifically cite Darwin's work: "Newton's laws of force and motion, Kepler's laws of planetary motion, conservation laws, Darwin's laws of natural selection, and chaos theory all exemplify the idea of order and regularity." (p. 116)

Fundamental concept: Evidence, models, and explanation

Information on the timeline is presented as what we understand now, and recognizes that our understanding may change in future. Charlie is a theorizing scientist. See kids' FAQs: "Hey! I learned something different..."

Fundamental concept: Change, constancy, and measurement

Evolution of animals over time is a wonderful example of change in "form and function of systems." (p. 118) The timeline also includes some examples of constancy: "living fossils" like the horseshoe crab. Its emphasis on geologic time and kinesthetic measurement with footsteps gives it a strong measurement component.

Contact: Kate Miller, President
kmiller@charliesplayhouse.com
Ph. 401-225-8325 Fax: 866-549-4635
999 Main Street, Unit 708, Pawtucket RI 02860
www.charliesplayhouse.com

Fundamental concept: Evolution and equilibrium

The general idea of evolution (“the present arises from materials and forms of the past.” p. 119) can be applied to many branches of science but biological evolution is an essential example.

Fundamental concept: Form and function

One way to learn that “the form or shape of an object or system is frequently related to use, operation, or function” (p. 119) is to hypothesize about strange past forms. What were *Stethacanthus*’ patches of teeth for? What could *Amargasaurus*’ spikes have been for?

Content standard C: Life science

Grades K-4: The timeline could be used to illustrate all the subpoints in two content standards: *characteristics of organisms* and *organisms and their environments*.

Grades 5-8: These content standards cover: *structure and function in living systems, reproduction and heredity, regulation and behavior, populations and ecosystems, and diversity and adaptations of organisms*. The specific content is a bit more in-depth than the timeline offers on its surface, but it would be a great starting point for further discussion.

Content standard D: Earth and space science

Grades K-4: The content standard *properties of Earth materials* expects students to learn that “fossils provide evidence about the plants and animals that lived long ago.” (p. 134)

Grades 5-8: Similarly, the content standard *structure of the Earth system* includes: “fossils provide important evidence of how life and environmental conditions have changed.” (p. 160)

Content standard F: Science in personal and social perspectives

Grades K-4: The content standard *changes in environments* defines “environments” and recognizes that they change. Previous mass extinctions and the current one caused by humans can be used to teach students that “changes in environments can be natural or influenced by humans.” (p. 140.)

Content standard G: History and nature of science

Grades K-4: The content standard *science as a human endeavor* reads: “Many people choose science as a career and devote their entire lives to

studying it. Many people derive great pleasure from doing science.” (p. 141) We hope Charlie will provide an exciting example!

Grades 5-8: Under the content standard *nature of science*, students should learn that “it is normal for scientists to differ with one another” and that “although all scientific ideas are tentative and subject to change and improvement in principle, for most major ideas in science there is much experimental and observational confirmation.” (p. 171) Information on the timeline is presented as what we understand now, and recognizes that our understanding may change in future. See kids’ FAQs: “Hey! I learned something different...”

The content standard *history of science* includes: “Tracing the history of science can show how difficult it was for scientific innovators to break through the accepted ideas of their time to reach the conclusions that we currently take for granted.” (p. 171) While not explicitly covered in the timeline, the fierce and continuing opposition to Darwin’s ideas is a wonderful example of this.

Benchmarks for Scientific Literacy

Content on the Giant Timeline can be used to teach toward several benchmarks established in: The American Association for the Advancement of Science, Benchmarks for Science Literacy, <http://www.project2061.org/publications/bsl/default.htm> (accessed June 2008).

Bench- mark	Subpart	By end of grade	Students should know that:	Relevance of Giant Timeline
1. The nature of science	A. The scientific world view	5	“Science is a process of trying to figure out how the world works by making careful observations and trying to make sense of those observations.”	Charlie appears throughout the Giant Timeline, making observations about animals. He was an extraordinarily careful and persistent observer of the natural world.
4: The Physical Setting	C. Processes that shape the Earth	2	“Change is something that happens to many things.”	The Giant Timeline displays changes in the animal world through time.
		2	“Animals and plants sometimes cause changes in their surroundings.”	The Giant Timeline includes the currently unfolding mass extinction, which is caused by human activity.

Benchmark	Subpart	By end of grade	Students should know that:	Relevance of Giant Timeline
		2	“Fossils can be compared to one another and to living organisms according to their similarities and differences. Some organisms that lived long ago are similar to existing organisms, but some are quite different.”	Children love to make comparisons between the exotic animals on the Giant Timeline and familiar animals of today. Also the Timeline includes some animals (Coelacanth, Horseshoe Crab, and Meganeura) whose modern and ancient forms are similar.
5: The Living Environment	A. Diversity of life	2	“Some animals and plants are alike in the way they look and in the things they do, and others are very different from one another.”	The 67 strange animals on the Giant Timeline offer great opportunities for comparing and contrasting.
		5	“A great variety of kinds of living things can be sorted into groups in many ways using various features to decide which things belong to which group.”	The Giant Timeline graphically sorts its animals by where they lived (land, sea or sky) and in which geologic period they lived. Other features that can be used for sorting, such as fins or bone armor, are discussed in the Giant Timeline’s text.
		5	“There are millions of different kinds of individual organisms that inhabit the earth at any one time—some very similar to each other, some very different.”	The Giant Timeline displays a small part of the immense biodiversity over time.
	D. Interdependence of life	2	“Animals eat plants or other animals for food and may also use plants (or even other animals) for shelter and nesting.”	Several animals on the Giant Timeline discuss their carnivorous or vegetarian diets.
		5	For any particular environment, some kinds of plants and animals thrive, some do not live as well, and some do not survive at all.”	In the center of the Giant Timeline, “Charlie” Darwin sits down with the reader to discuss natural selection in simple terms. This discussion includes the ideas of fitness and the effects of environmental changes.
		5	“Changes in an organism's habitat are sometimes beneficial to it and sometimes harmful.”	
	F. Evolution of life	2	“Different plants and animals have external features that help them thrive in different kinds of places.”	Charlie’s discussion on natural selection addresses this. Also the Giant Timeline points out several animals’ features that help them survive, such as Climatius’ jaws.

Benchmark	Subpart	By end of grade	Students should know that:	Relevance of Giant Timeline
		2	“Some kinds of organisms that once lived on Earth have completely disappeared, although they were something like others that are alive today.”	All but four of the animals on the Giant Timeline are extinct today, but several of their similarities to living animals are pointed out in the text. In addition, Charlie discusses extinction in one of his appearances.
		5	“Individuals of the same kind differ in their characteristics, and sometimes the differences give individuals an advantage in surviving and reproducing.”	The Giant Timeline does not delve deeply into variation within species, but Charlie’s speech on natural selection (see above) touches it indirectly.
		5	“Fossils can be compared to one another and to living organisms according to their similarities and differences. Some organisms that lived long ago are similar to existing organisms, but some are quite different.”	Children love to make comparisons between the exotic animals on the Giant Timeline and familiar animals of today. Also the Timeline includes some animals (Coelacanth, Horseshoe Crab, and Meganeura) whose modern and ancient forms are similar.
11: Common themes	C. Constancy and change	2	“Objects change in some ways and stay the same in some ways.”	Changes in the forms of life are vividly displayed on the Giant Timeline.
		2	“Some things change so slowly or so quickly that the changes are hard to notice while they are taking place.”	Understanding the enormity of geologic time is important to understanding evolution and its slow pace. The Giant Timeline presents geologic time in three ways: visually (through its sheer length), graphically (with time markers) and kinesthetically (children can follow footprints at 40 million years per step.)
	D. Scale	2	“Things in nature and things people make have very different sizes, weights, ages, and speeds.”	The Giant Timeline shows the huge variation in size of animals over time, and includes size comparison figures (a 4-foot child) for many of its creatures.