

Why Do Florida's K-12 Students Need These New World-Class Science Standards?



Math & Science
Solutions for Florida's Future

Indicators of Need

- Low student science performance on state, national, and international assessments
- Persistent achievement gaps among demographic subgroups
- Decreasing ACT science scores
- Lack of preparation of graduating seniors for post-secondary education and the workforce
- Low ratings of current standards
- Increased academic preparation requirements of Florida's fastest growing occupations
- As a nation, we are falling behind in the production of scientists and engineers.

Florida's Current Science Standards

- Goal 3 Science Standards were written to guide science curriculum in 1993; “Science for All Students.”
- Science Sunshine State Standards were first developed and adopted in 1996.
- GLE’s for grades K-8 followed in 1999.
- Rated F three times by The Fordham Institute: 1998, 2000 with the new GLE’s, and 2005 using a 100-point rubric earning only 48 points (ranked 37th out of 50).

How do Florida's current K-8 standards compare with world-class models?

Mile wide – Inch deep

	Florida	NAEP¹	Singapore² #1 TIMSS	Finland³ #1 PISA
# K-8 GLE's	607	113	226	184
GLE's per grade level	67	14	38	20

¹The 2009 NAEP science framework encompasses grades 1-8.

²Singapore begins science instruction at grade 3 and continues for a total of six years through lower secondary.

³Finland's science standards encompass grades 1-9.

Effort

Identification and procurement of:

- international and national leading science standards, research, and researchers
- 33 Framers, well respected stakeholders to voluntarily identify and guide the process
- 25 Writers, well respected scientists, science educators, and others to voluntarily draft the evidence-based world-class standards
- 23 Writers of Access Points including Exceptional Student Education Specialists

Production of Draft 1

- 10 meetings utilizing all resources listed above

Effort

Draft 1 Review

- ④ Public web-based system accessible October through December resulting in:
 - ✓ 10,017 Reviewers
 - ✓ 262,524 Ratings
 - ✓ 20,993 Comments
- ④ Four Public Hearings
- ④ Hundreds of Emails and Letters
- ④ Expert Review by Scientists, Post-Secondary Science Educators, National Science Content Experts

Review Results

- Draft 1 review by Dr. Lerner of The Fordham Institute resulted in a unofficial rating of B+.
- Online average rating is on scale of:
1 (strongly disagree) to 5 (strongly agree) = 4.3.
- Lowest number of ratings per item is 235, highest 1,042.
- Greater than 75% of big ideas and benchmarks were revised responding to public and expert review.
- Old grade level expectations require low levels of learning by students: know or understand; new benchmarks require higher levels of understanding and active learning by students: observe and create, compare, sort, differentiate, classify, measure and compare, investigate, explain...

Public On-line Review Results

- 📍 Highest Rating - SC.912.P.1.5:** Describe the structure of atoms in terms of protons, neutrons and electrons, and differentiate among these particles in terms of their sizes, electrical charges and locations.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
3	1	5	96	251
0.84%	0.28%	1.40%	26.97%	70.51%

- 📍 Final Wording and Coding – SC.912.P.8.4:** Describe the structure of atoms in terms of protons, neutrons and electrons, and differentiate among these particles in terms of their mass, electrical charges and locations within the atom.

Public On-line Review Results

- Lowest Rating - SC.7.E.2.1:** Recognize and describe that fossil evidence is consistent with the idea that human beings evolved from earlier species.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
345	31	25	55	257
48.39%	4.35%	3.51%	7.71%	36.04%

- Final Wording and Coding – SC.7.L.15.1:** Recognize that fossil evidence is consistent with the theory that living things evolved from earlier species.

Note: There was one lower rated benchmark based on percent strongly agree, but the majority rated agree and strongly agree.

Significant Revisions to Big Ideas

Final Draft

To increase clarity and match content progression

- ④ Organization and Development of Living Organisms
- ④ Diversity and Evolution of Living Organisms
- ④ The Practice of Science
- ④ The Characteristics of Science
- ④ The Role of Theories, Laws, Hypotheses, and Models
- ④ Science and Society

Additionally, narratives were rewritten as advised by the Board of Science Education to better align text to student developmental levels.

Draft 1

- ④ Organization and Development
- ④ Evolution and Diversity
- ④ Nature of Science

Results

4 Bodies of Knowledge, 18 Big Ideas, 498 Benchmarks, and 952 Access Points:

Nature of Science

1. The Practice of Science
2. The Characteristics of Science
3. The Role of Theories, Laws, Hypothesis, and Models
4. Science and Society

Earth and Space

5. Earth in Space and Time
6. Earth Structures
7. Earth Systems and Patterns

Physical Science

8. Properties of Matter
9. Changes in Matter
10. Forms of Energy
11. Motion of Objects
12. Forces and Change in Motion

Life Science

14. Organization and Development of Living Organisms
15. Diversity and Evolution of Living Organisms
16. Heredity and Reproduction
17. Interdependence
18. Matter and Energy Transformations

Results for Grades K - 8:
From 606 to 288 total benchmarks,
From an average to 67 to 32 per grade =

**More Time
for
Inquiry-
Based
Instruction**

Grade Level	Number of <u>Old</u> Grade Level Expectations	Number of <u>New</u> Benchmarks
K	36	19
1 st	47	19
2 nd	54	30
3 rd	55	32
4 th	60	42
5 th	59	37
6 th	97	35
7 th	98	34
8 th	100	40

Science 9-12

<u>Old</u> 9-12 Benchmarks (Same for all 9-12)	<u>New</u> Body of Knowledge Benchmarks
<ul style="list-style-type: none">● 11 for The Nature of Matter● 8 for Energy● 8 for Force and Motion● 5 for Processes that Shape the Earth● 10 for Earth and Space● 11 for Processes of Life● 9 for How Living Things Interact with Their Environment● 15 for Nature of Science	<ul style="list-style-type: none">● 26 for Earth and Space● 117 for Life Science● 38 for Physical Science● 21 for Nature of Science

Thanks!

- To the public for their engagement and participation in this effort, attending to the education of children in Florida.
- To the national, state, university, community college, district, school, and classroom science education stakeholders who produced this world-class set of education standards for the children in Florida.
- To the staff of the Department of Education and the Office of Math and Science who remained professionally dedicated to the workload and communications requirements of this effort for the children in Florida.

Support for Adoption of Standards as Proposed

- National Academy of Sciences
- American Institute of Biological Sciences
- Florida Citizens for Science, over 1,700 signatures that include former Florida State University and University of South Florida Presidents and the current University of Miami President, Donna Shalala
- The Council for the Florida Academy of Sciences
- Florida Association of Science Supervisors
- University of Florida Department of Geological Sciences
- University of South Florida Department of Chemistry
- Nobel Laureate, Dr. Harry Kroto, Chemist
- Chair of the University of Florida Botany Department, Douglas Soltis
- Dr. Richard Adicks, Professor Emeritus, University of Central Florida
- Hugh Balboni, former Superintendent of St. Johns County School Board
- Clay County Science Teachers
- Florida Academy of Sciences
- Bill Castine, Ph. D., 30-year Science Educator at Florida A&M, certified lay speaker in the United Methodist Church
- Bob Howland, M.S. Zoology, UF, Astronomy, Earth/Space, and Physics Teacher, Buchholz High School
- Many more...lists from public hearings, including a Catholic Priest
- Debra Walker, Framer, Monroe County School Board
- Paul Ruscher, Framer, Meteorologist
- Hon Kie Ng, Framer, Physicist
- Curtis Wolf, Framer, Florida Citizens for Science
- Ellen Granger, Writer, Biologist
- Eileen Tramontana, Framer, Environmentalist
- Sue Dixon, Framer, Exceptional Student Educator
- Susan Cooper, Writer, Post Secondary Biology Educator
- Nancy Stokely, Framer, Exceptional Student Educator
- Michelle Ferro, Writer, Elementary Science Teacher
- Gerry Meisels, Framer, Writer, Director of the Coalition of Science Literacy
- Rick Ellenburg, Writer, Florida Teacher of the Year, Elementary Science Teacher
- Takumi Sato, Writer, Science Graduate Student
- Janet Acerra, Framer, Florida Association of Science Teachers
- Melody Boeringer, Writer, Chemistry Teacher
- Penny Haskins, Framer, Radiation Technologies
- Andrea Valdovinos, District Science Specialist
- Molly Malloy, Writer, District Science Specialist
- Horst Wahl, Framer, Physicist
- Michael Fauerbach, Framer, Professor of Physics and Astronomy
- Ron Good, Framer, Science Researcher
- Barry Golden, Writer, Science Graduate Student
- Margaret Hayden, Secondary Science Resource Teacher
- Brian McClain, Writer, High School Science Teacher
- Cush Copeland, Writer, High School Science Teacher
- Mary Bahr, Writer, Middle School Science Teacher
- Beth Geils, Writer, Elementary Science Teacher
- Judith Megaw, Writer, Chemistry Teacher
- Jane Pfielsticker, Writer, District Board Member
- Donna Poniatowski, Writer, District Science Supervisor
- Julie Roth, Writer, District Elementary Supervisor

Option

- ④ Insert “Scientific Theory of” where appropriate as determined by scientists to be scientifically accurate
- ④ Insert “Law of” where appropriate as determined by scientists to be scientifically accurate