SETI Institute

Bringing Space Down to Earth and into the Classroom

Edna DeVore
Director of Education & Outreach
SETI Institute

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NASA's Vision

The NASA SMD vision for Education is:

- To share the story, the science, and the adventure of NASA's scientific explorations of our home planet, the solar system and the universe and beyond through stimulating and informative activities and experiences created by experts, delivered effectively and efficiently to learners of many backgrounds via proven conduits, thus providing a return on the public's investment in NASA's scientific research

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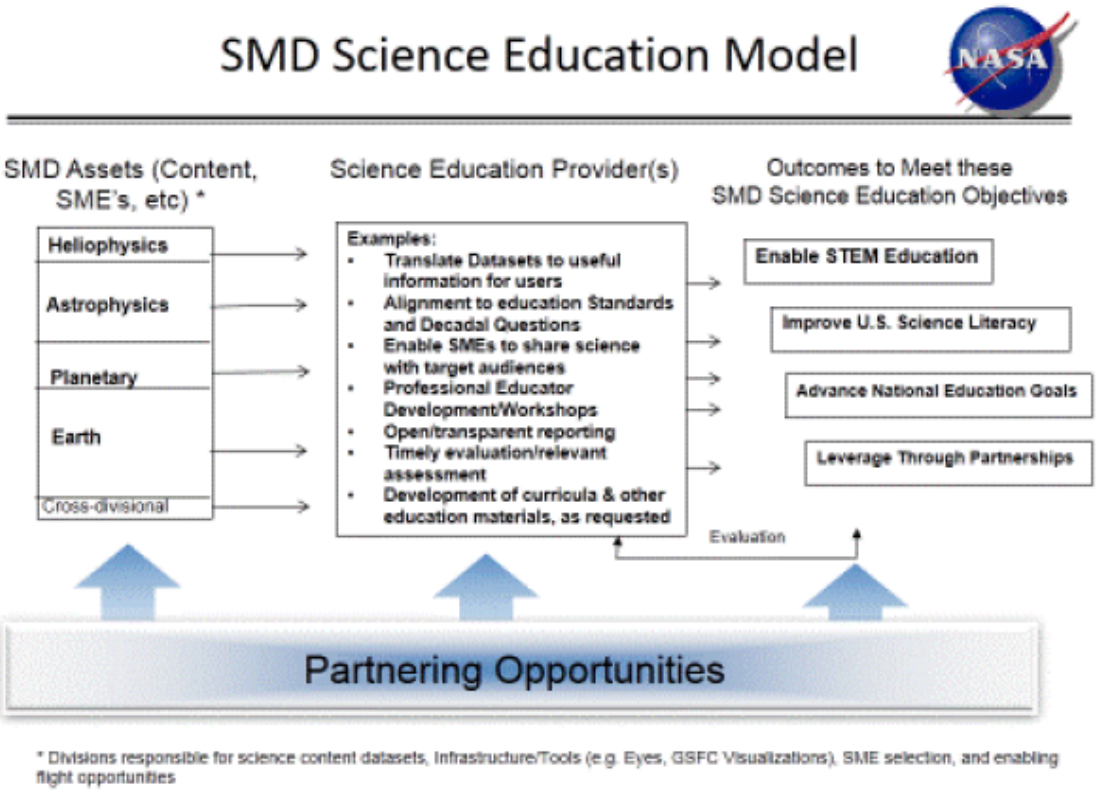
SMD Model



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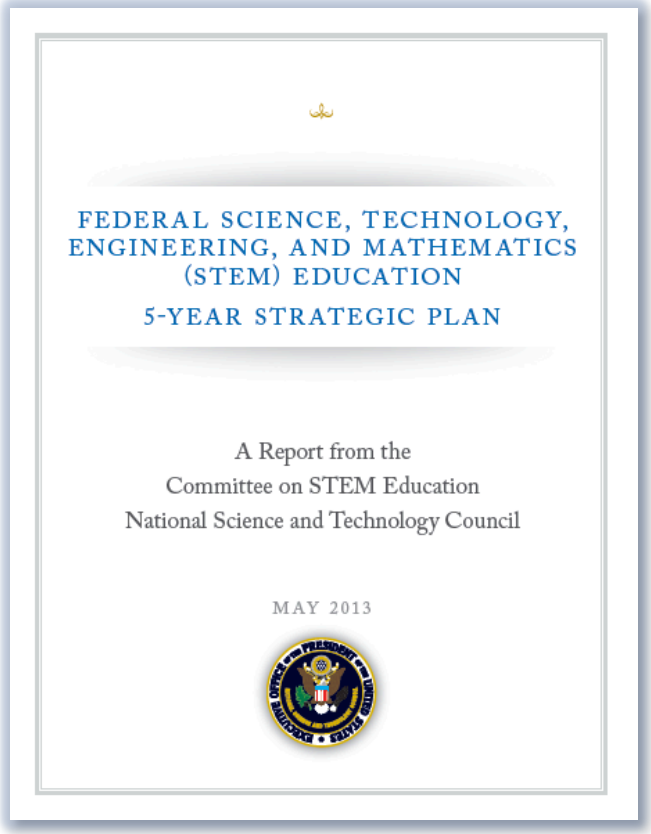
National Science and Technology Council
Federal STEM Education 5-Year Strategic Plan

Five priority STEM education investment areas.

- Improve STEM instruction
- Increase and sustain youth and public engagement in STEM
- Enhance STEM experiences for undergraduate students
- Better serve groups historically under-represented in STEM fields
- Design graduate education for tomorrow's STEM workforce



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Improve STEM Instruction

Prepare 100,000 excellent new K-12 STEM teachers by 2020, and support the existing STEM teacher workforce

NASA/IPAC Teacher Archive Research Program

STEM Teacher as Researcher

SOFIA
Stratospheric Observatory for Infrared Astronomy

Airborne Astronomy Ambassadors

Increase and Sustain Youth and Public Engagement in STEM

Support a 50 percent increase in the number of U.S. youth who have an authentic STEM experience each year prior to completing high school.

Robotics

Rocketry

Cube satellites

Enhance STEM Experience of Undergraduate Students

Graduate one million additional students with degrees in STEM fields over the next 10 years

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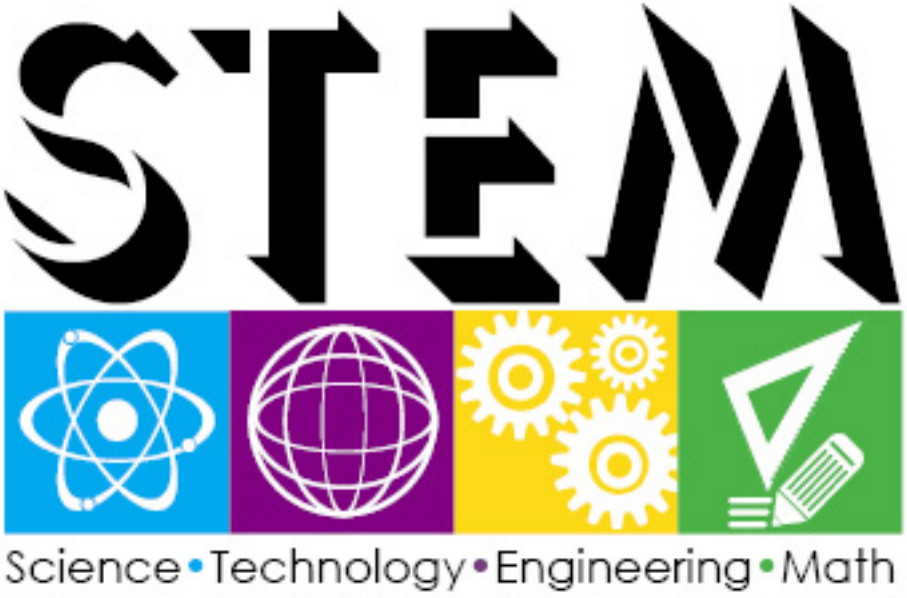
Better Serve Groups Historically Underrepresented in STEM Fields

Increase the number of students from groups that have been underrepresented in STEM fields that graduate with STEM degrees in the next 10 years and improve women's participation in areas of STEM where they are significantly underrepresented.



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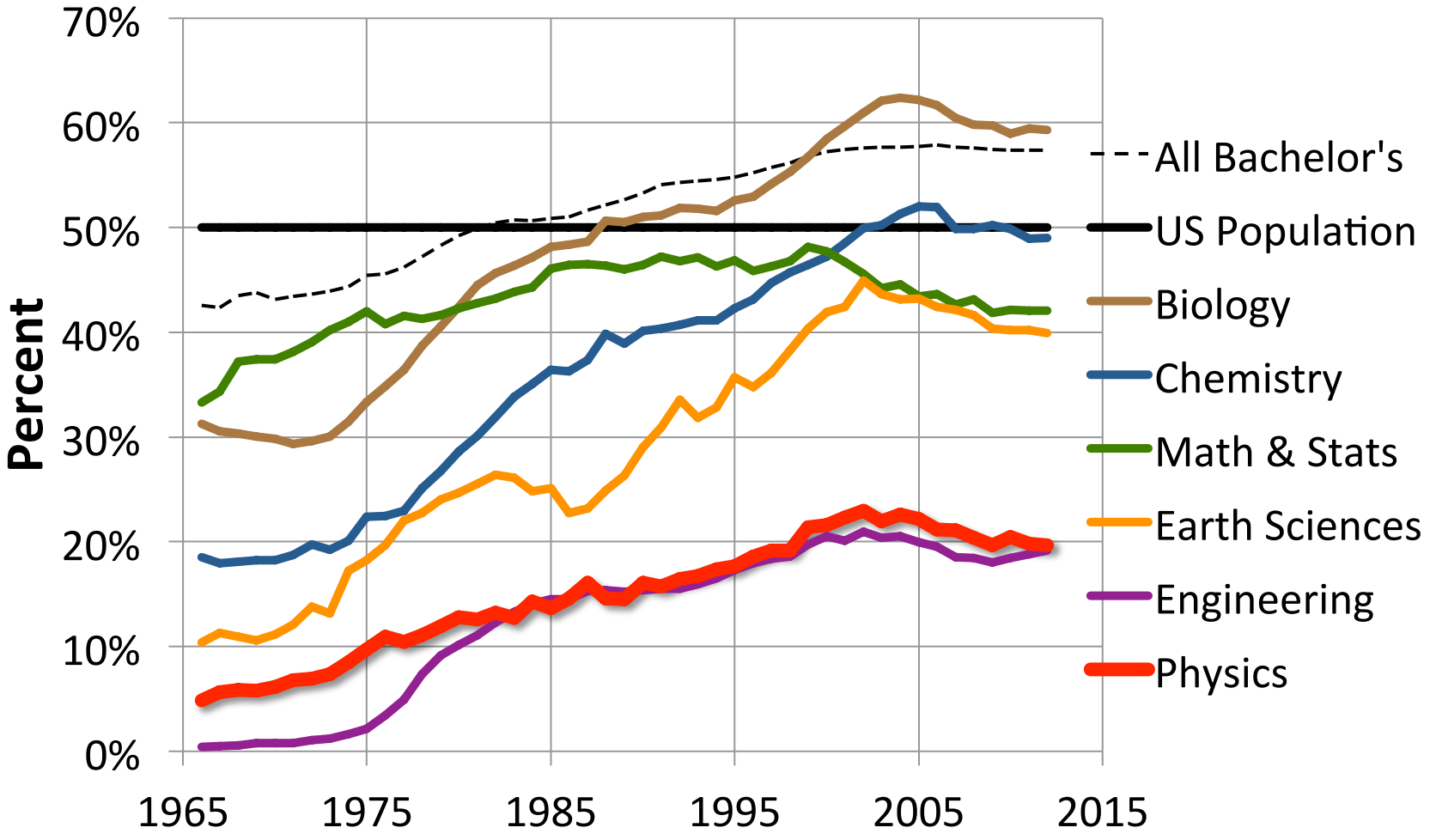
Percent of Bachelor's Degrees Earned by Women, by Major



Data: American Physical Society

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Better Serve Groups Historically Underrepresented in STEM Fields

Increase the number of students from groups that have been underrepresented in STEM fields that graduate with STEM degrees in the next 10 years and improve women's participation in areas of STEM where they are significantly underrepresented.

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Design Graduate Education for Tomorrow's STEM Workforce

Provide graduate-trained STEM professionals with basic and applied research expertise, options to acquire specialized skills in areas of national importance, mission-critical workforce needs for the CoSTEM agencies, and ancillary skills needed for success in a broad range of careers.

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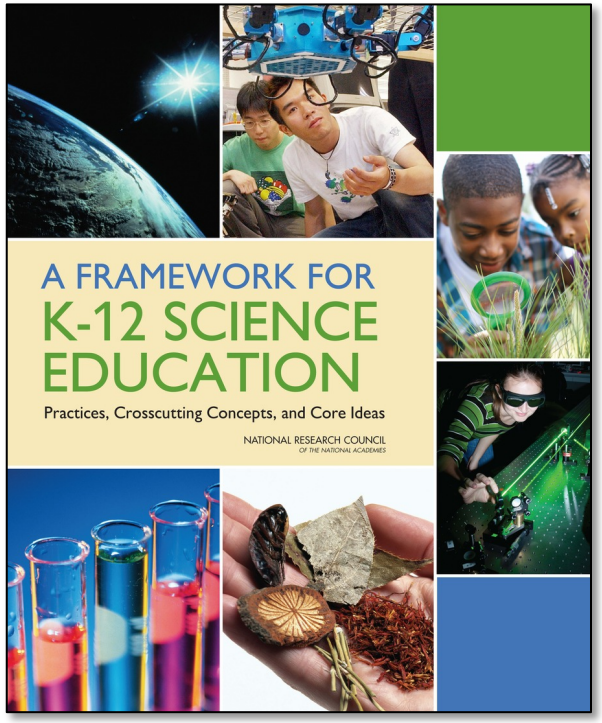
Challenge:
How do NASA's programs match the *Framework* and the *NGSS*?



July 2011

April 2013

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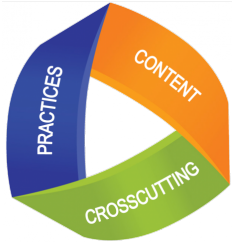
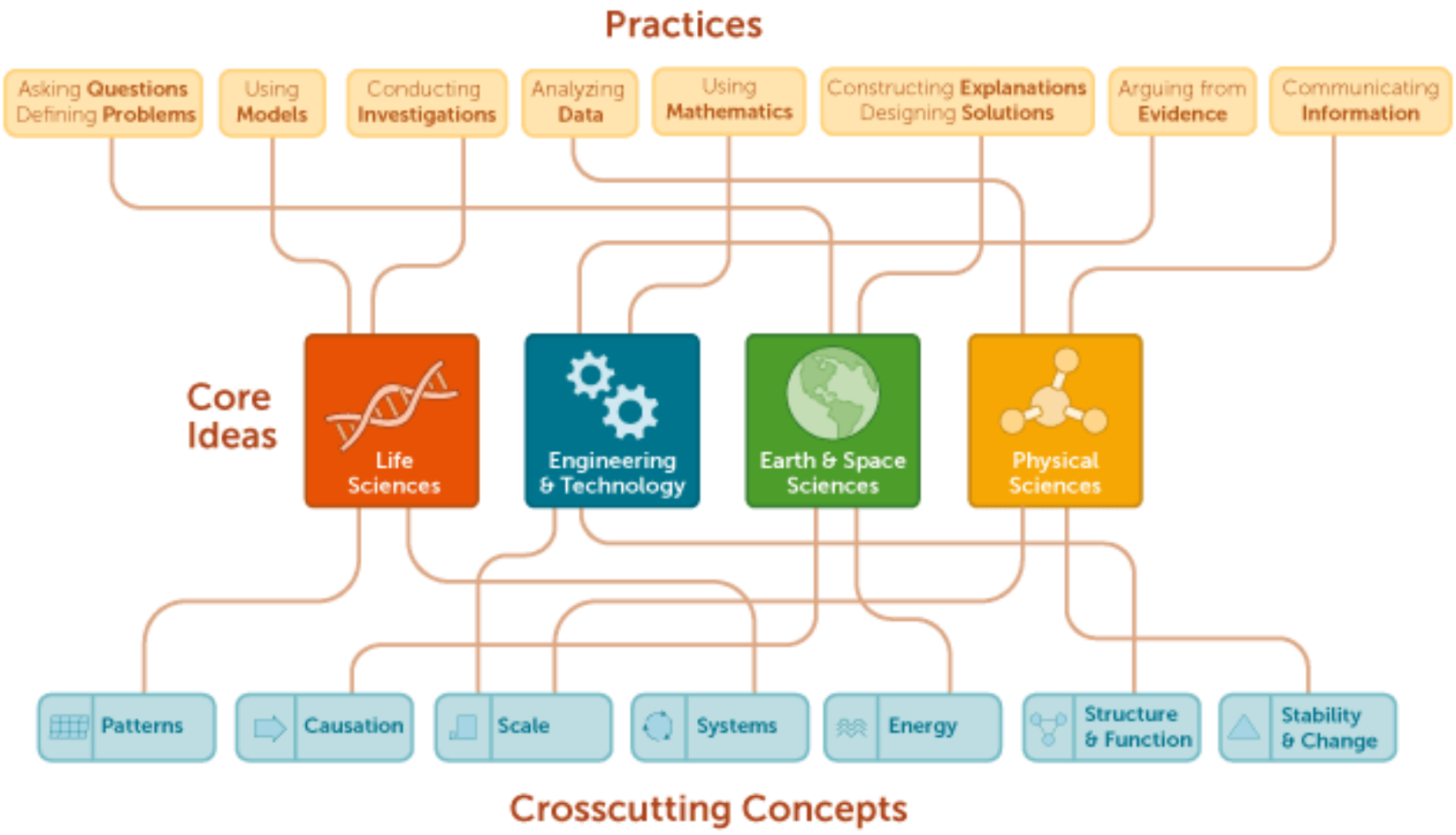
Next Generation Science Standards





Challenge:
How to match NASA's programs with the *Framework* and the *NGSS*?

EQuIP

EQuIP (Educators Evaluating the Quality of Instructional Products) is an initiative designed to identify high-quality materials aligned to the Common Core State Standards.

Rubric helps measure alignment with:

- Practices
- Crosscutting concepts
- Core Disciplines

Achieve

All students should graduate from high school ready for college, careers and citizenship.

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Achieve Rubric for NGSS Alignment

EQuIP Rubric for Lessons & Units: Science

Reviewer Name or ID: **Grade:**
Science Lesson/Unit Title:

I. Alignment to the NGSS

The lesson or unit aligns with the conceptual shifts of the NGSS:

Criteria	Specific evidence from materials and reviewers' reasoning	Suggestions for improvement
☐ A. Grade-appropriate elements of the science and engineering practice(s), disciplinary core idea(s), and crosscutting concept(s), work together to support students in three-dimensional learning to make sense of phenomena and/or to design solutions to problems. i. Provides opportunities to develop and use specific elements of the practice(s) to make sense of phenomena and/or to design solutions to problems. ii. Provides opportunities to develop and use specific elements of the disciplinary core idea(s) to make sense of phenomena and/or to design solutions to problems. iii. Provides opportunities to develop and use specific elements of the crosscutting concept(s) to make sense of phenomena and/or to design solutions to problems. iv. The three dimensions work together to support students to make sense of phenomena and/or to design solutions to problems.		

A unit or longer lesson will also:

Criteria	Specific evidence from materials and reviewers' reasoning	Suggestions for improvement
☐ B. Lessons fit together coherently targeting a set of performance expectations. i. Each lesson links to previous lessons and provides a need to engage in the current lesson. ii. The lessons help students develop proficiency on a targeted set of performance expectations.		
☐ C. Where appropriate, disciplinary core ideas from different disciplines are used together to explain phenomena.		
☐ D. Where appropriate, crosscutting concepts are used in the explanation of phenomena from a variety of disciplines.		
☐ E. Provides grade-appropriate connection(s) to the Common Core State Standards in Mathematics and/or English Language Arts & Literacy in History/Social Studies, Science and Technical Subjects.		

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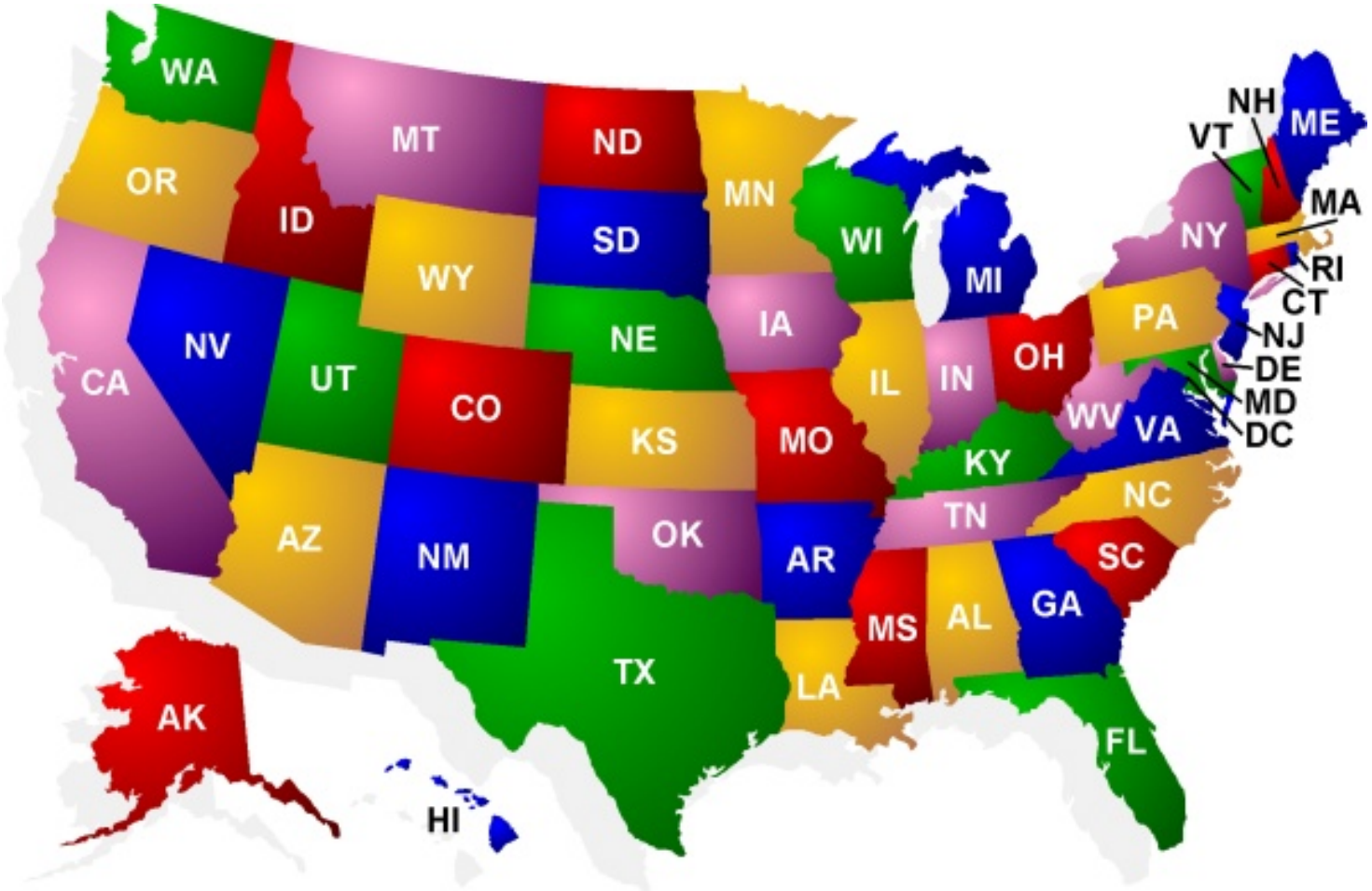
Challenge: Who uses the *Framework* and *NGSS*?



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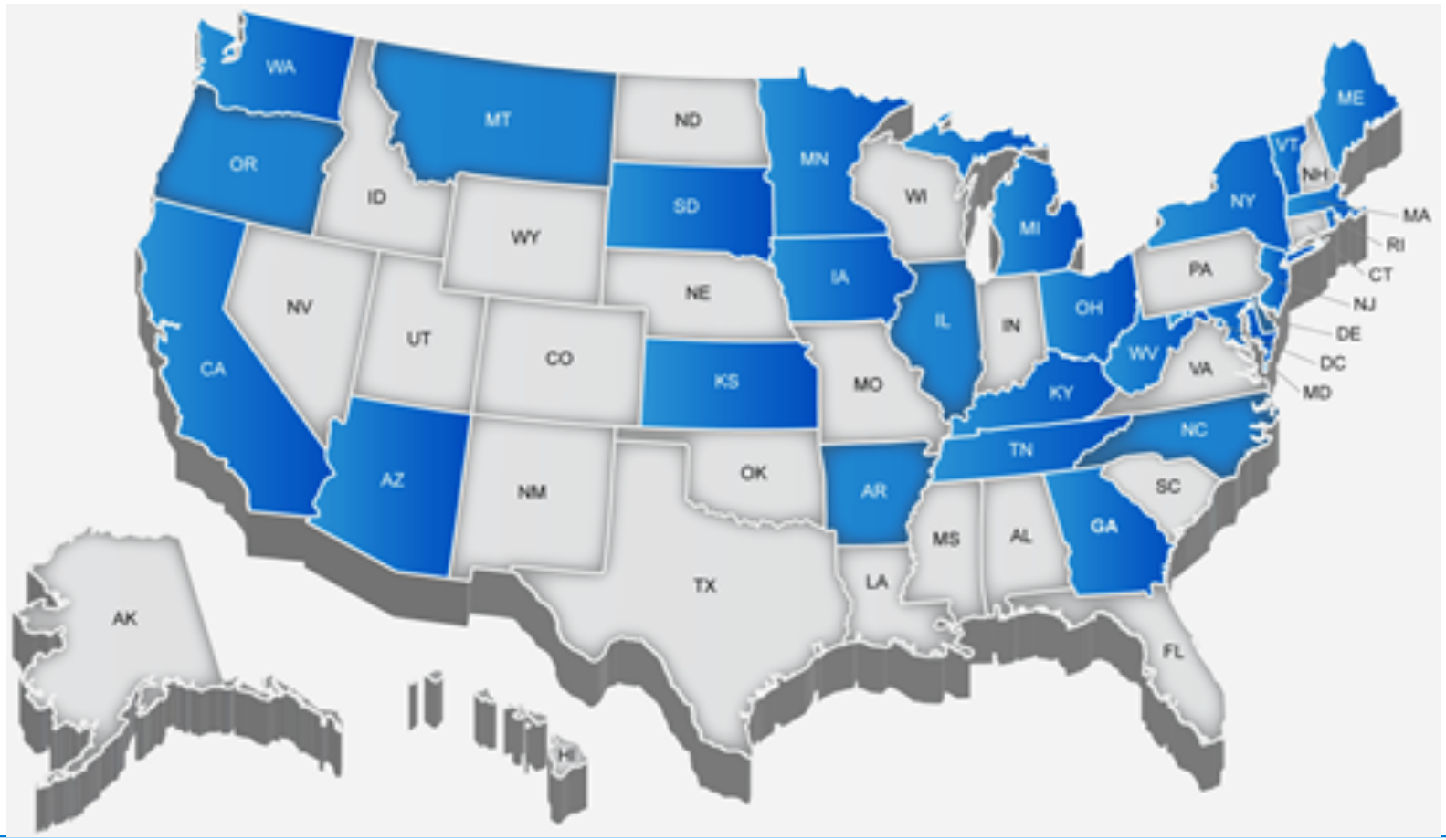
NEXT GENERATION SCIENCE STANDARDS

For States, By States



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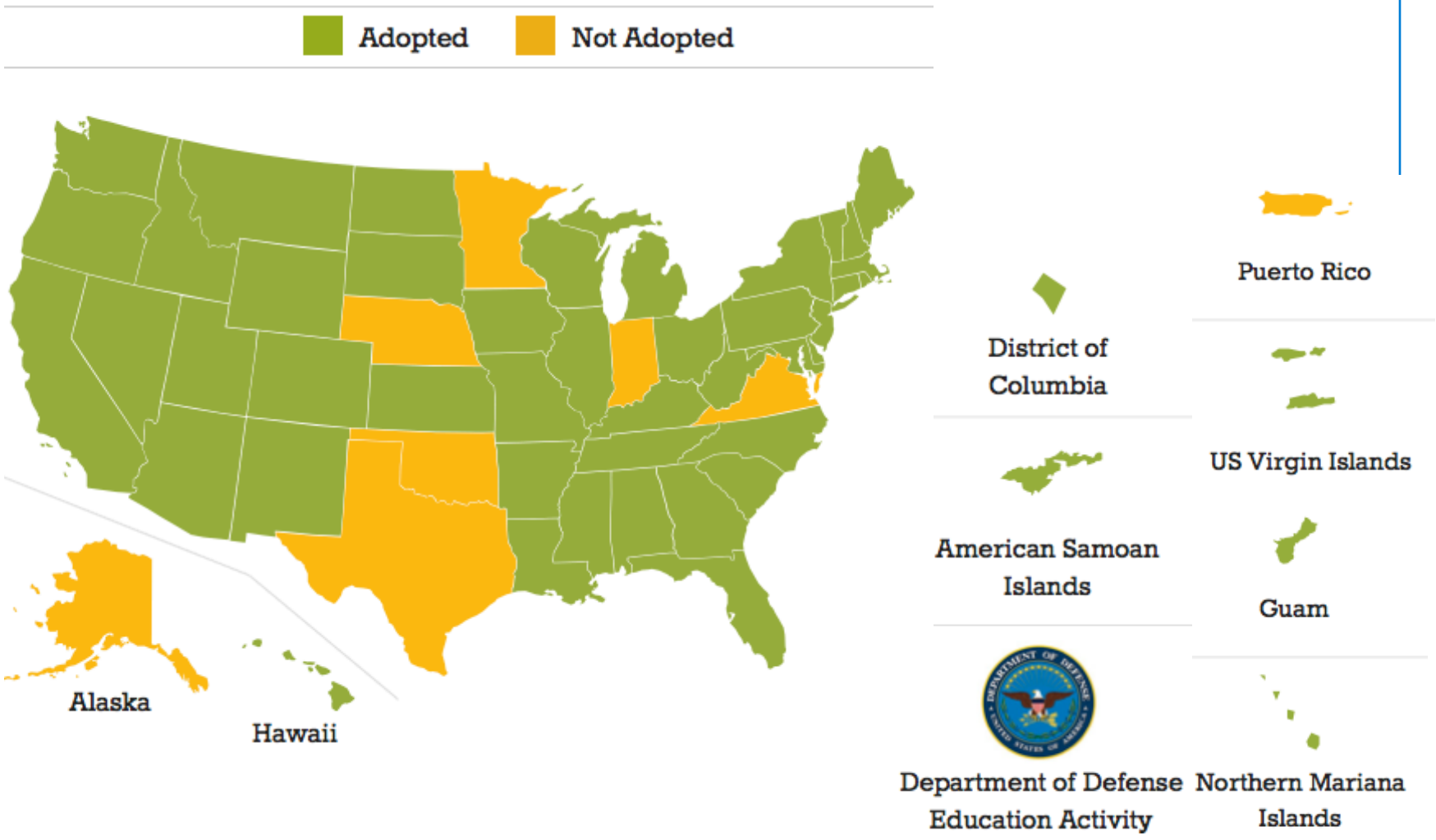
Common Core Standards for Reading and Mathematics



Source: Common Core State Standards Initiative

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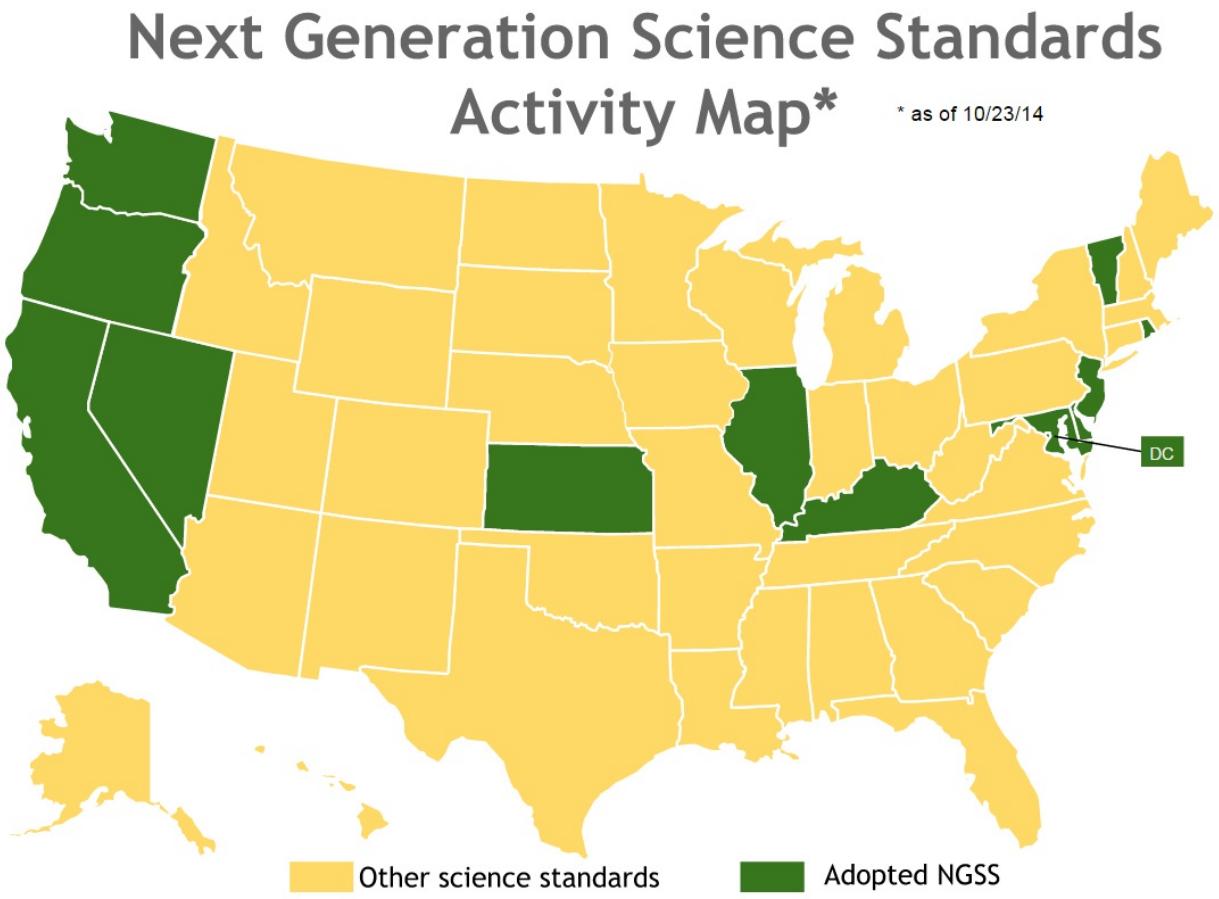
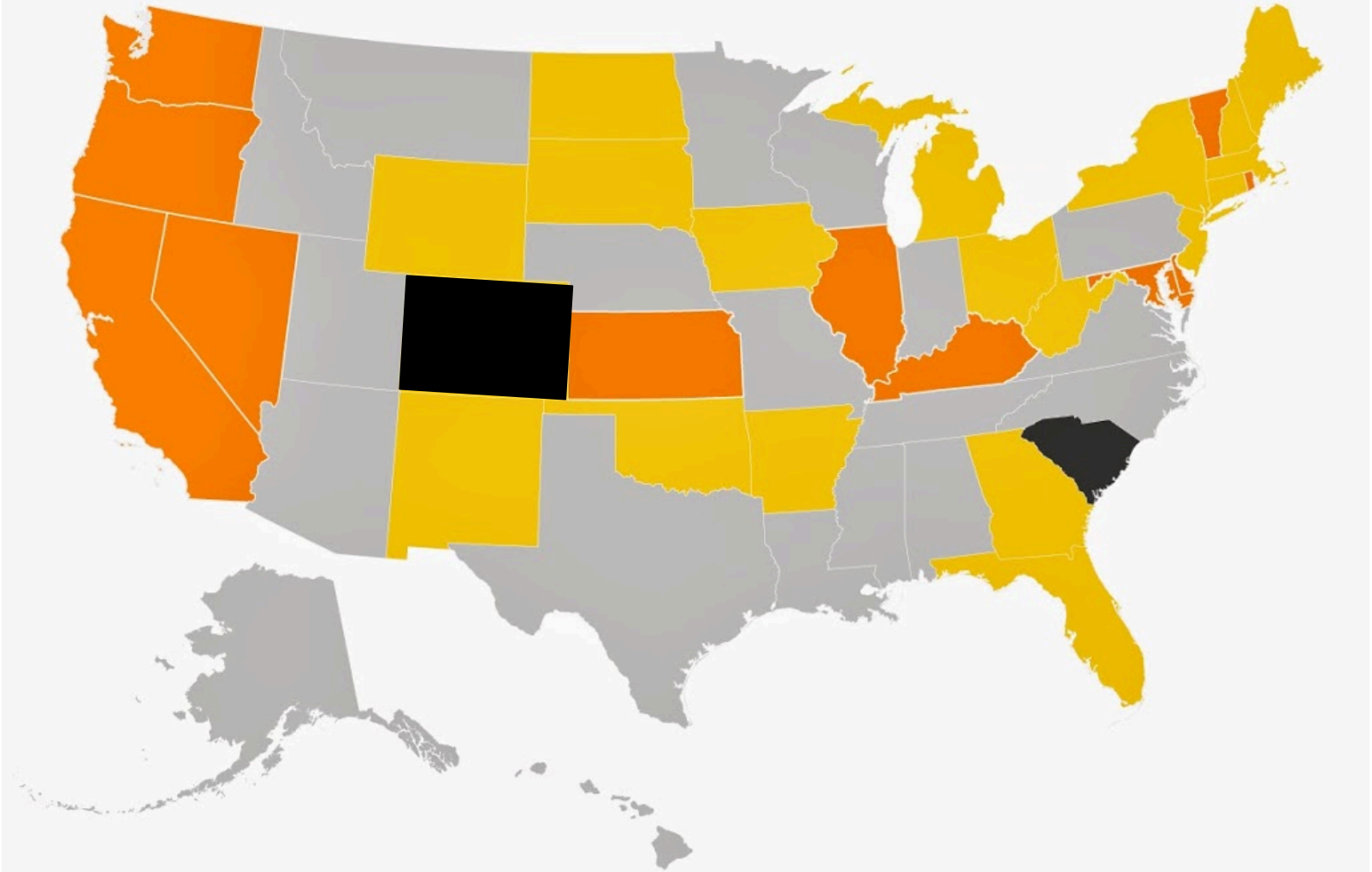
NGSS Adopted: 12 States + DC



Next Generation Science Standards (NGSS) Activity Map



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Standards: The Challenge

- NASA SMD Education supports NASA's Vision for Education, which reflects *Federal STEM Education 5-Year Strategic Plan*
- NASA Education programs need to think *nationally* yet *serve State and local needs*.
- *Framework* and *NGSS* are new, and still undergoing adoption
- Education is the constitutional responsibility of the States.
- State and local property taxes pay 90%+ of $700 Billion
- States formulate state standards
- Districts implement or adapt State standards
- Schools/teachers develop curriculum based on State or District standards
- Teachers implement the curriculum

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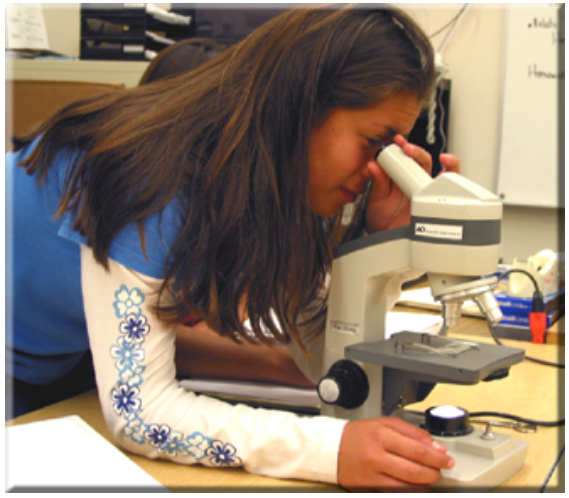
Challenge:
How can NASA best encourage and support teachers to use NASA Education resources in the classroom?

Challenge:
Reaching Teachers and Students

- 67,000 public elementary schools
- 35 million students grades K-8
- 1.7 million teachers
  -18,000 science
  -32,000 math

Challenge:
Reaching Teachers and Students



- 25,000 public high schools
- 15 million students grades 9-12
- 1.7 million teachers
  -209,000 science
  -250,000 math

Challenge:
Reaching Teachers and Students

- ~50 million students in all schools, K-12
- 92,000 public schools
- 33,370 private schools
- ~3.4 million public school teachers
  -227,000 science
  -282,000 math
- ~456,000 private school teachers

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Challenge:
What do Teachers and Students Need?

Needs assessment:

- Inspiration?
- Motivation?
- Teacher professional development?
- Standards-based materials?
- New inquiry-based lessons?
- New hands-on labs?
- Simulations?
- NASA data for teacher and student use?
- Assessment tools?

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Inspiration and Motivation

- NASA has great stories
- Adventure and exploration
- Amazing discoveries
- Exciting careers

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Professional Development

- Exposure: NSTA, State conferences, websites
- Instruction: presentations in-person, video, online
- In-depth training:
  - institutes
  - courses
  - sustained relationship to a community
- Research experiences/internships
- Sustained relationships with scientists, engineers and other educators

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Continuum of scientist-engineer's engagement in science education

Observatory/Research Site
Laboratory

Teacher/Scientist Partnerships

Mentoring teachers/students

Pre-service & In-service Teacher Preparation

Reform curriculum development

Text products web, print, media

Lecture with slides

Classroom

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Continuum of scientist-engineer's engagement in science education

Observatory/Research Site
Laboratory

NASA's people:
- 18,000 civil servants
- 40,000 contractors

Teacher/Scientist Partnerships

Mentoring teachers/students

Pre-service & In-service Teacher Preparation

Reform curriculum development

Text products web, print, media

Lecture with slides

Classroom

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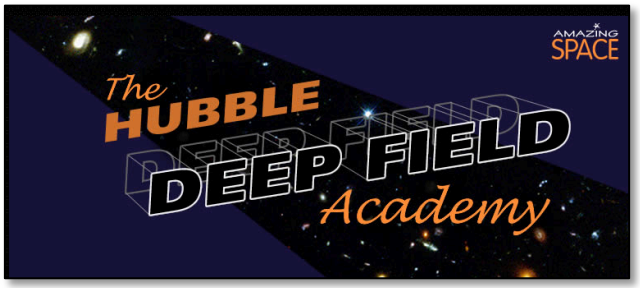
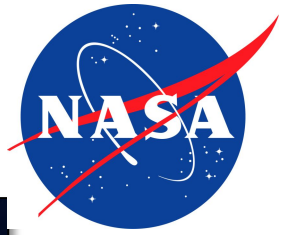
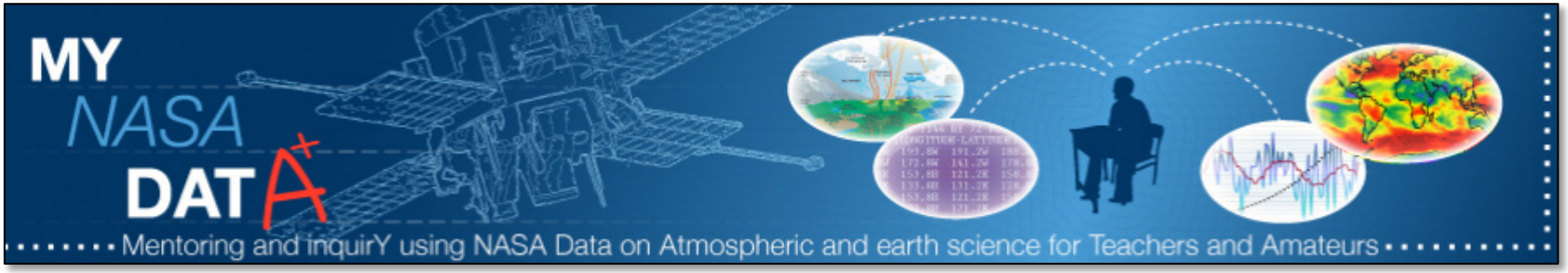
How Can We Have the Greatest Impact?







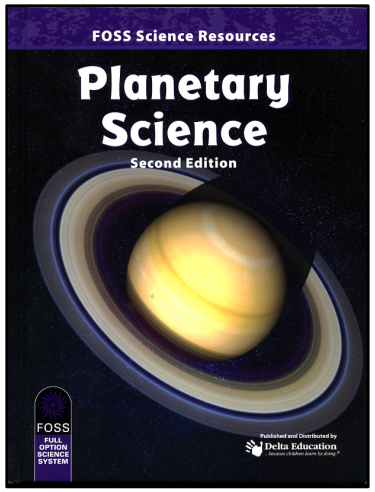
No Shortage of On-line Materials….

- NASA Wavelength Digital Library: 2,134 lessons
- NASA Summer of Innovation: 90 lessons

Beyond NASA…..

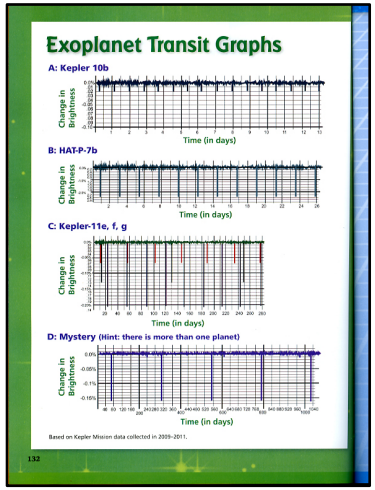
- *Open Culture Portal*
  - 950 free, online courses
  - 675 online films
  - 550 free audio books
  - 600 free eBooks
  - online language instruction: 46 languages
  - 200 free kids educational lessons
    (video, apps, books, websites)

Middle School *Planetary Science* Published!

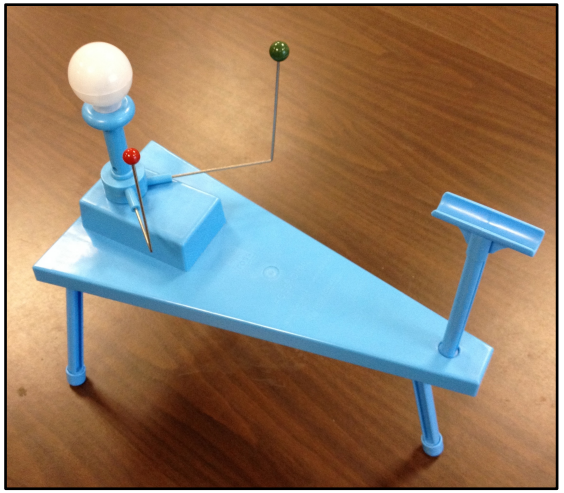


The FOSS (Full Option Science System) ***Planetary Science*** middle school module is a kit-based course, with hard-copy teacher guide, student materials, plus web-based resources. ***Kepler EPO infused Kepler science and discoveries in the newly revised Planetary Science course.*** FOSS curriculum is used in all fifty states by over 100,000 teachers and 2 million students; it is in about 16% of the nation's school districts. More importantly, FOSS is adopted in 50 of the 100 largest urban school districts where FOSS reaches large populations of under-served students.

NASA Missions demonstrations



Lesson on discovering exoplanets



Orrery from teacher kit for transit

Lawrence Hall of Science, UC Berkeley & the SETI Institute lead the Kepler EPO program in cooperation with the Kepler Science Office, ARC.

Expanded Reach through Partnerships*

ORGANIZATIONS

Space Grant Consortia
Learning.com
WorldWide Telescope
American Library Association
National Federation of the Blind
Night Sky Network
Spitz Digital Institute
Maryland Science Center
The After-School Institute

TEXTBOOKS/CURRICULUM

Houghton Mifflin
Lawrence Hall of Science
NSTA SciGuides
Brooks/Cole
McGraw-Hill
Harcourt
Scholastic
Open Court
MacMillan
Baltimore County Curriculum & Star Lab Program

* OPO at STScI

Expanded Reach through Partnerships

UNIVERSITIES

Johns Hopkins University
Morgan State University
University of Texas at Austin
University of Chicago
Georgia State University
California State University, Sacramento
Penn State University
Virginia Tech University
Immaculata University

DIVERSITY

Morgan State
Baltimore City After School Institute
Women's Collaborative Project
Tactile Astro
STEMcx

STATE DEPTS. OF EDUCATION

Texas, Mississippi, Virginia, Pennsylvania, California, Ohio, South Carolina

Selected by 27 states, and used in all 50.

* OPO at STScI

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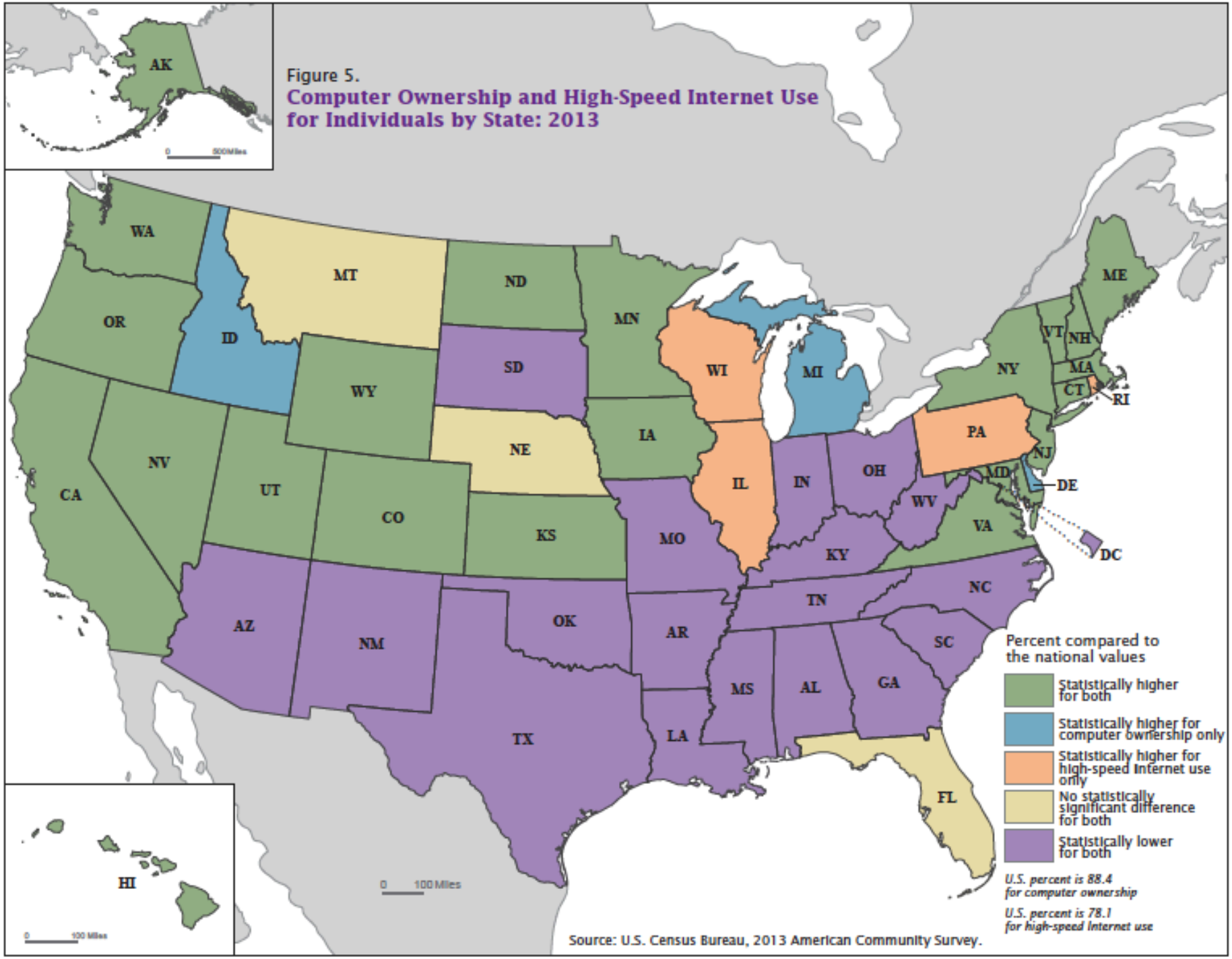
Does the Digital Divide Exist?

At School:

- 3.1 students per computer
- Band-width issues remain

At Home—Impacted by:

- Age
- Ethnicity
- Income


AK
0 500 Miles
Figure 5.
Computer Ownership and High-Speed Internet Use for Individuals by State: 2013
WA
OR
CA
ID
NV
MT
WY
UT
AZ
CO
NM
ND
SD
NE
KS
OK
TX
MN
IA
MO
AR
LA
WI
IL
MS
MI
IN
KY
TN
AL
OH
WV
GA
FL
SC
NC
VA
PA
NY
MD
DE
NJ
CT
RI
MA
VT
NH
ME
DC
HI
0 100 Miles
0 100 Miles
Percent compared to the national values
Statistically higher for both
Statistically higher for computer ownership only
Statistically higher for high-speed Internet use only
No statistically significant difference for both
Statistically lower for both
U.S. percent is 88.4 for computer ownership
U.S. percent is 78.1 for high-speed Internet use
Source: U.S. Census Bureau, 2013 American Community Survey.

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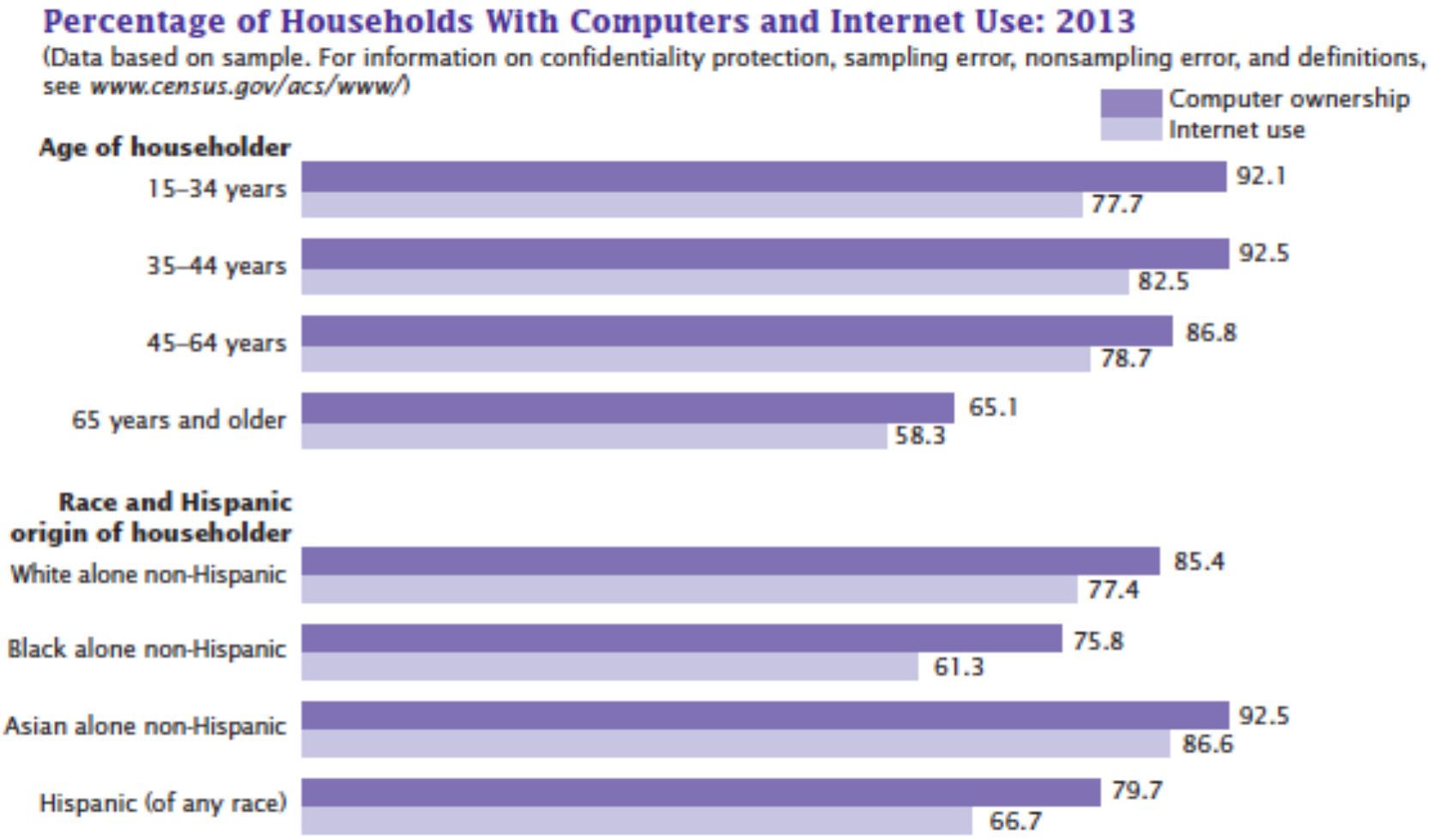
Age &Ethnicity Impact on Computer Use



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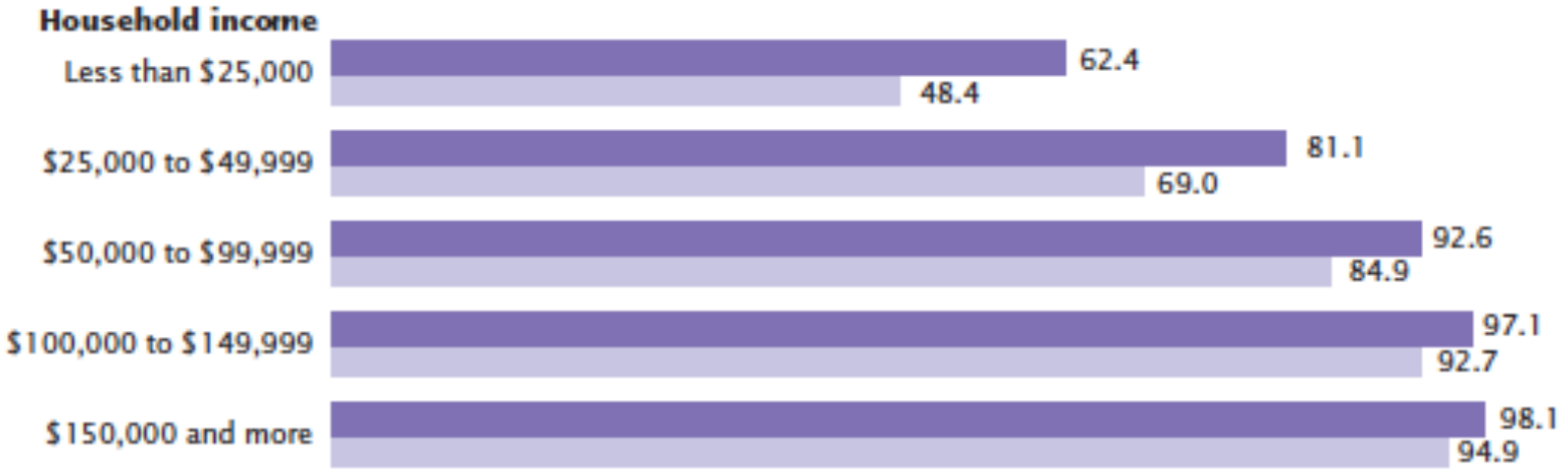
Income Impact on Computer Use



Note: About 4.2 percent of all households reported household Internet use without a paid subscription. These households are not included in this figure.
Source: U.S. Census Bureau, 2013 American Community Survey.

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Challenge:
Bringing Space Down to Earth and into the Classroom

- *To share the story, the science, and the adventure of NASA's scientific explorations of our home planet, the solar system and the universe and beyond through stimulating and informative activities and experiences created by experts, delivered effectively and efficiently to learners of many backgrounds via proven conduits, thus providing a return on the public's investment in NASA's scientific research*

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Conclusion:

- NASA Education can make a difference
- Be attentive to Standards: *Framework*, *NGSS*, and *State Standards*
- Identify the needs of teachers and students
- Engage in teacher professional development
- Leverage partnerships to maximize reach and impact
- Continue to reach across the digital divide to schools and homes to deliver NASA's story
- Think nationally; be prepared to act locally.

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Need to make contact?

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