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NAEP 2009 Science Gr. 4 & 8

Jan Martin, South Dakota NAEP State Coordinator
Jan.martin@state.sd.us

Presentation Overview

- NAEP Science Framework
  - How does the framework compare to state standards?
- Overview of results for 2009
  - What is the good news? Where is there room for improvement?
- Digging into released items
  - Items and Item Maps
- Grade 8 NAEP/TIMSS Linking Study

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Science Overview

- NAEP results are available for the nation and the 46 states plus Dept. of Defense schools.
- Results are available for grade 4 and 8 at the state and national level. Grade 12 was a national only sample.
- New framework so only one data point, no trend data.
- Results are reported in scale scores, percents at achievement levels, and in percentiles for the state and the nation. District, school, or student data are not reported.

Organization of Science Content

- **Content areas**
  - ✓Physical Science
  - ✓Life Science
  - ✓Earth & Space Sciences
- **Topics**
  - **Subtopics**
    - **Grade-specific content statements**

Content: Topics and Sub-Topics

Physical	Life	Earth/Space
Matter -- Properties of matter -- Changes in matter **Energy** -- Forms of energy -- Energy transfer and conservation **Motion** -- Motion at the macroscopic level -- Forces affecting motion	**Structures and Functions of Living Systems** -- Organization and development -- Matter and energy transformations -- Interdependence **Changes in Living Systems** -- Heredity and reproduction -- Evolution and diversity	**Earth in Space and Time** -- Objects in the universe -- History of Earth **Earth Structures** -- Properties of Earth materials -- Tectonics **Earth Systems** -- Energy in Earth systems -- Climate and weather -- Biogeochemical cycles

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Science Practices

Identifying Science Principles	Using Science Principles
Demonstrates knowledge of science principles	Focuses on what makes science knowledge valuable
Using Scientific Inquiry	**Using Technological Design**
Focuses on key inquiry practices that are practical to measure	Involves systematic process of applying science principles and skills to solve design problems in a real-world context

Item Types

- Multiple Choice Items
- Constructed Response Items
  - Short
  - Extended
- Combination Items
  - Item clusters
  - Predict-observe-explain item sets
- Assessment time – approximately 50% constructed response
- Hands-on performance tasks & Interactive computer tasks – a separate study at national level

Distribution of Items by Content Area

Target Percentage of Student Response Time

	Grade 4 (%)	Grade 8 (%)	Grade 12 (%)
Physical	33.3	30.0	37.5
Life	33.3	30.0	37.5
Earth/Space	33.3	40.0	25.0

Distribution of Items by Science Practice

Target Percentage of Student Response Time

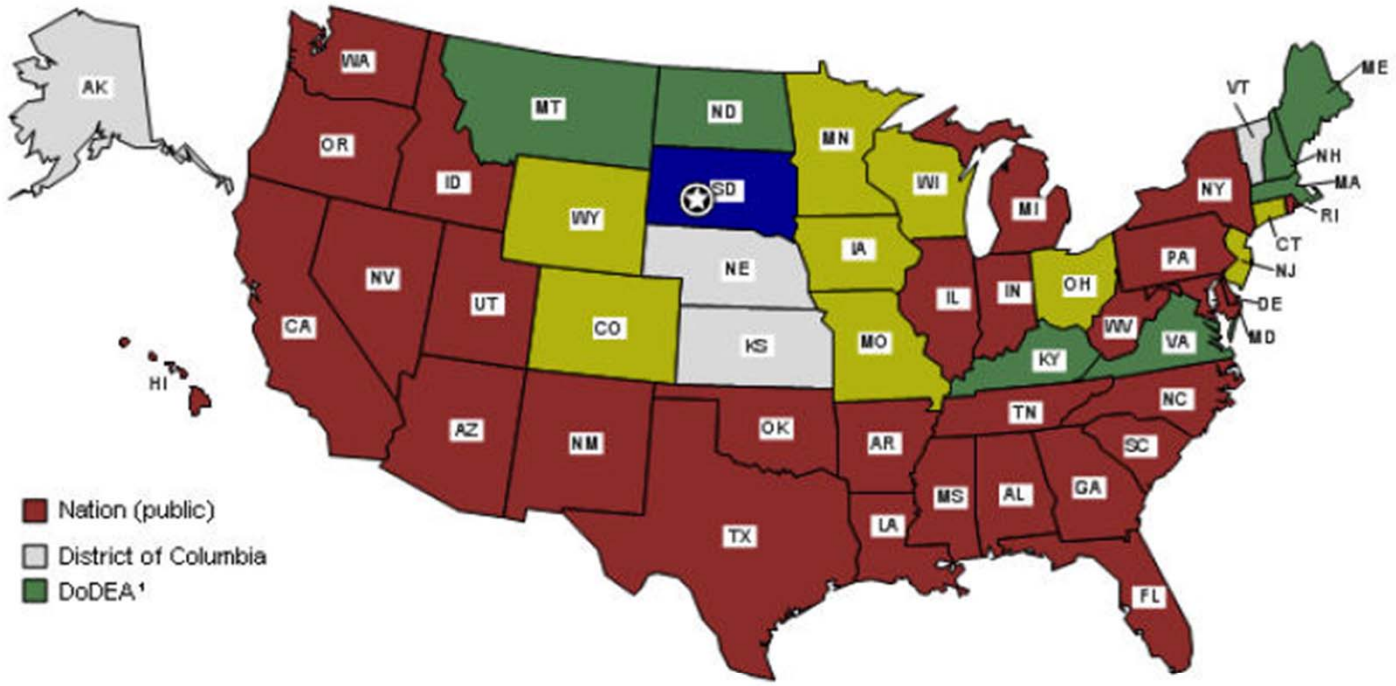
	Grade 4 (%)	Grade 8 (%)	Grade 12 (%)
Identifying Science Principles	30	25	20
Using Science Principles	30	35	40
Using Scientific Inquiry	30	30	30
Using Technological Design	10	10	10

Cognitive Demand

- Knowing That (*declarative knowledge*)
- Knowing How (*procedural knowledge*)
- Knowing Why (*schematic knowledge*)
- Knowing When and Where to Apply Knowledge (*strategic knowledge*)

- ✓ Used as a lens to facilitate item development
- ✓ Provide framework to analyze student responses
- ✓ One or more cognitive demand associated with each Science Practice
- ✓ Balance across the Science Practices ensures a range of cognitive demands will be covered in items

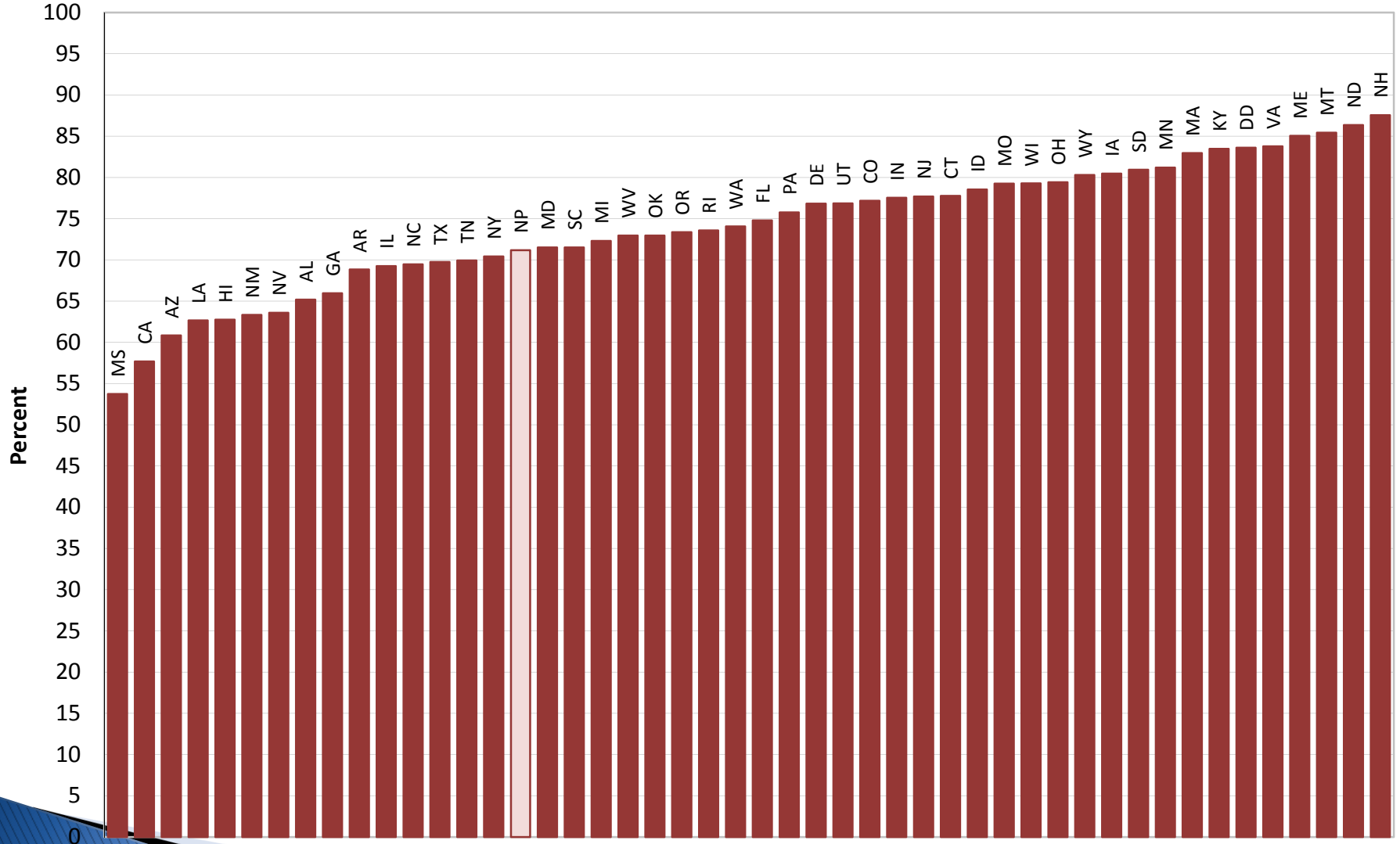
Grade 4 Results as compared to the nation and other states



★	Focal state/jurisdiction (South Dakota)
	Higher average scale score than South Dakota (8 jurisdictions)
	Not significantly different from South Dakota (9 jurisdictions)
	Lower average scale score than South Dakota (nation and 29 jurisdictions)
	5 jurisdictions did not participate.

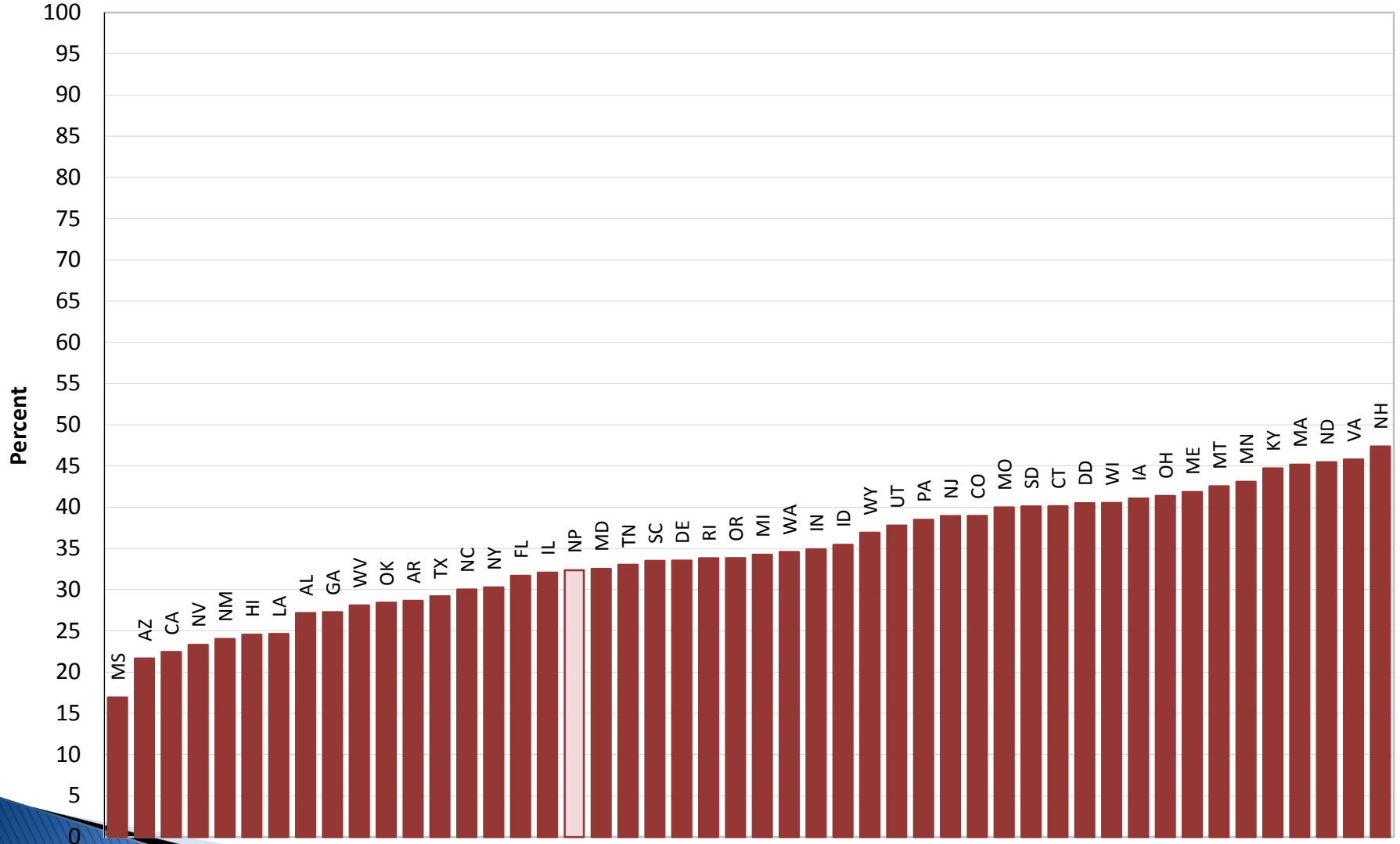
NAEP Science Grade 4 – Overall

At or Above Basic: 2009



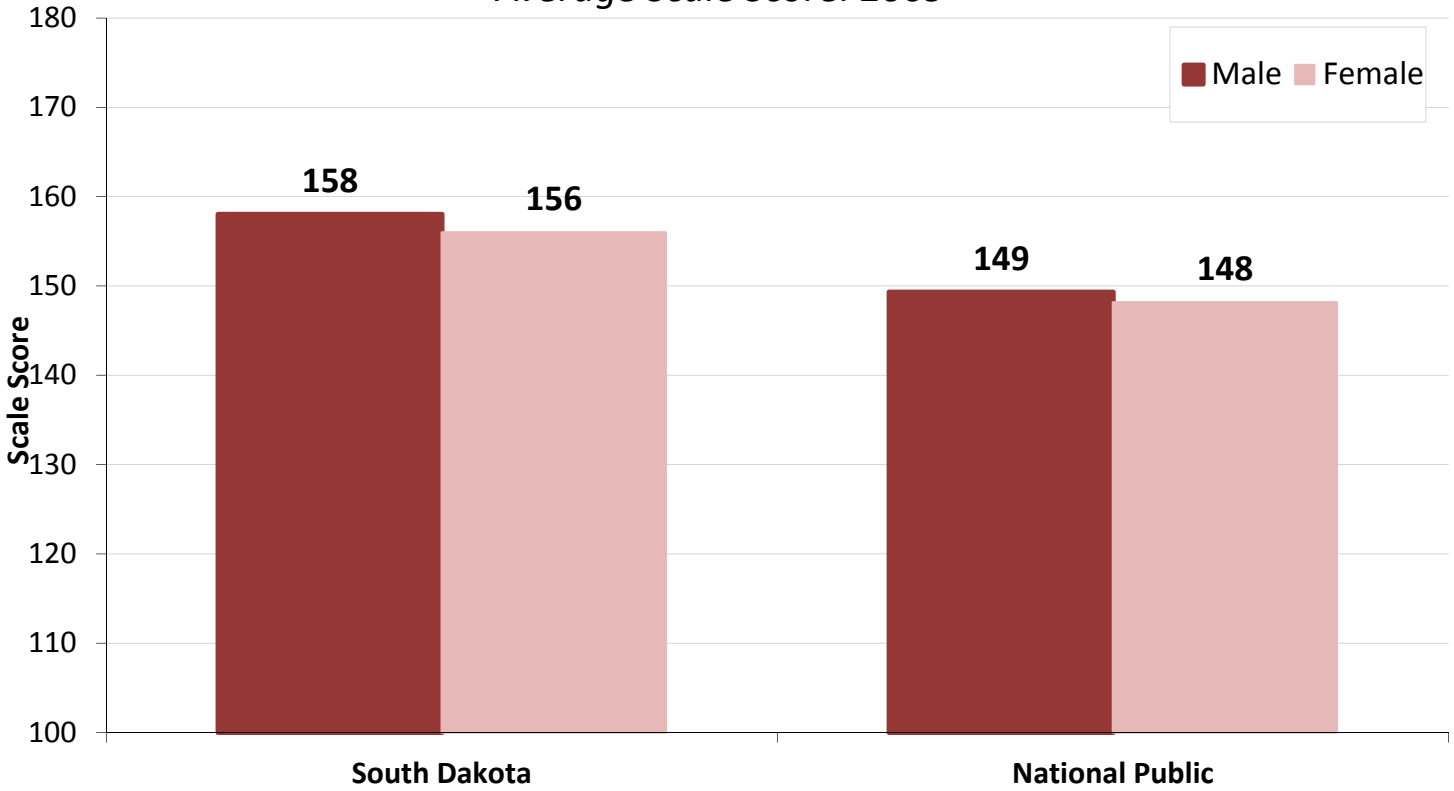
NAEP Science Grade 4 – Overall

At or Above Proficient: 2009



NAEP Science Grade 4 – Gender

Average Scale Score: 2009



NOTE: The NAEP Science scale ranges from 0 to 300. Observed differences are not necessarily statistically significant.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational

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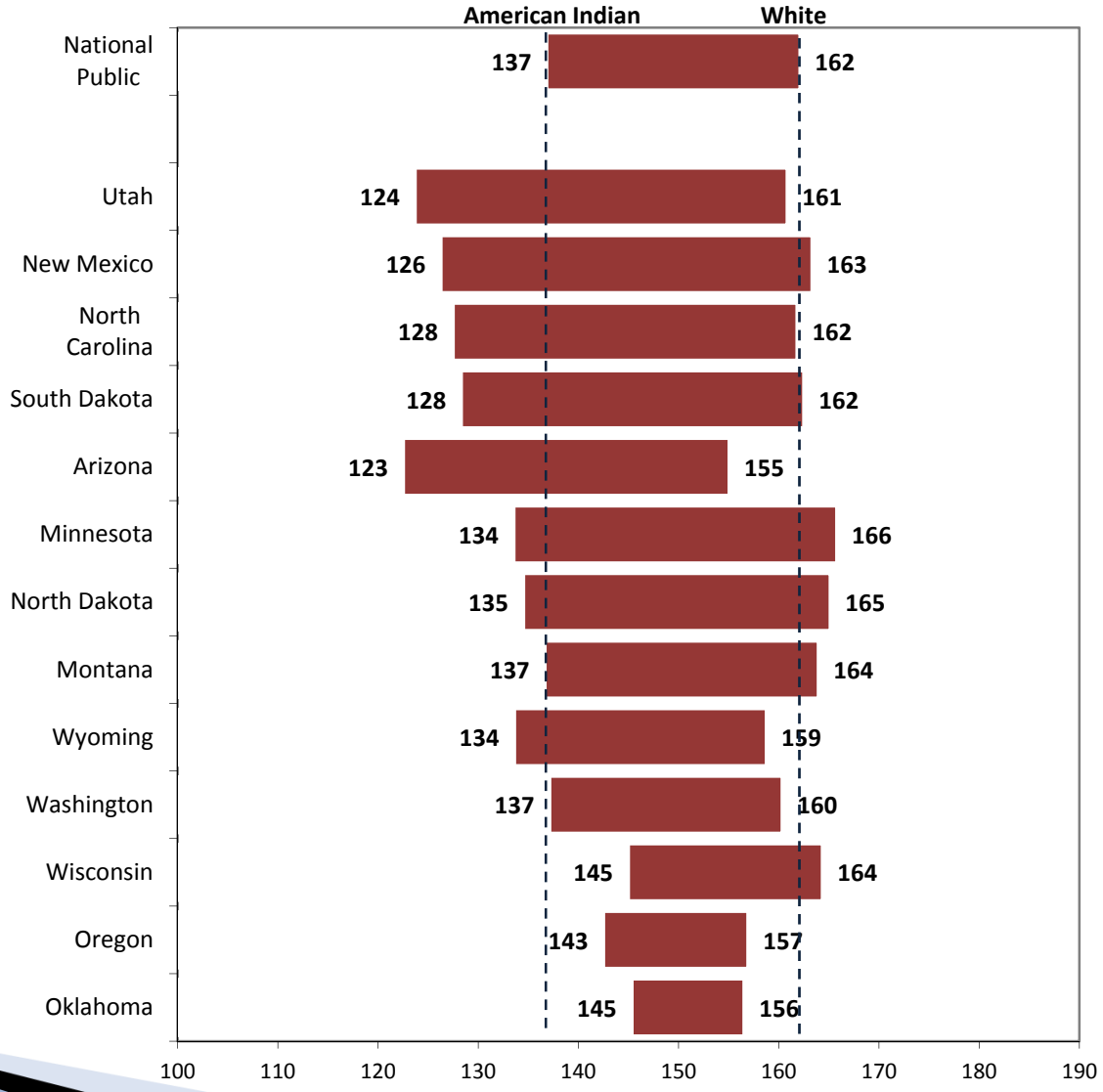
NAEP Science Grade 4 – White - American Indian

Gap - Average Scale Score: 2009



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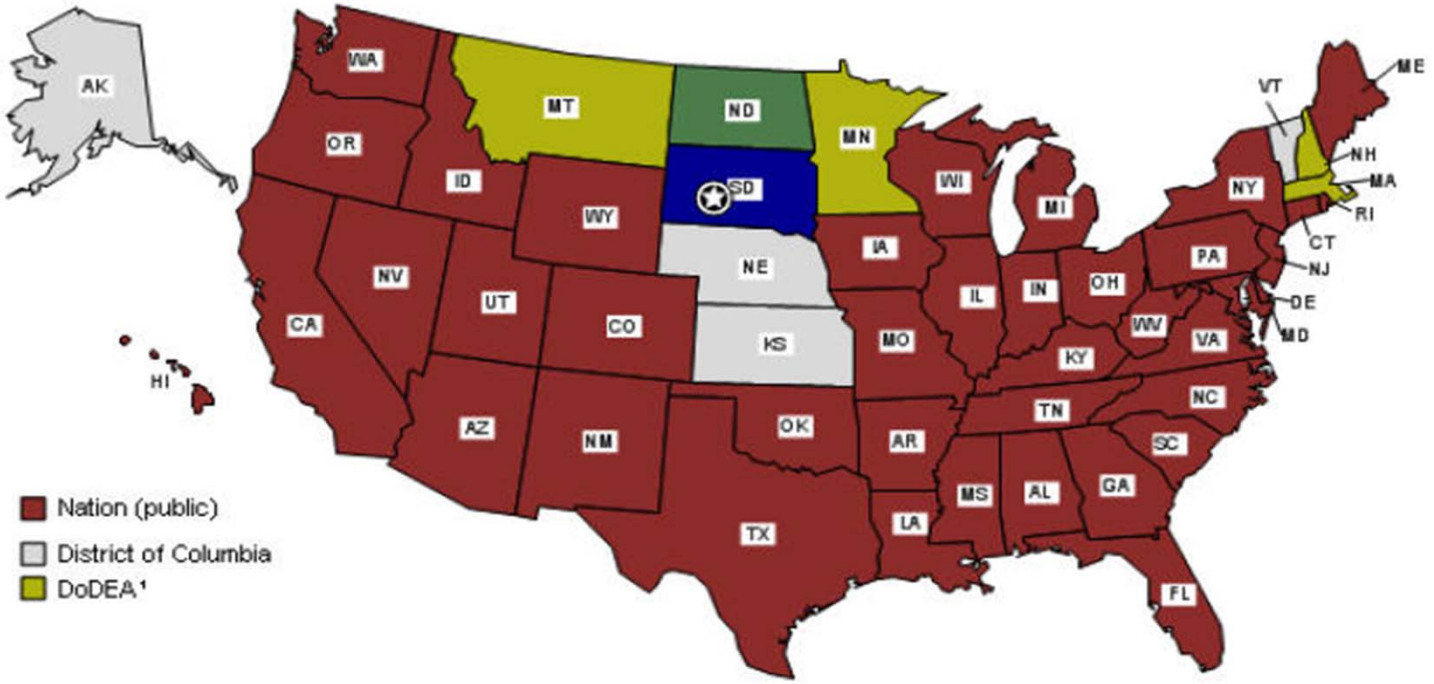
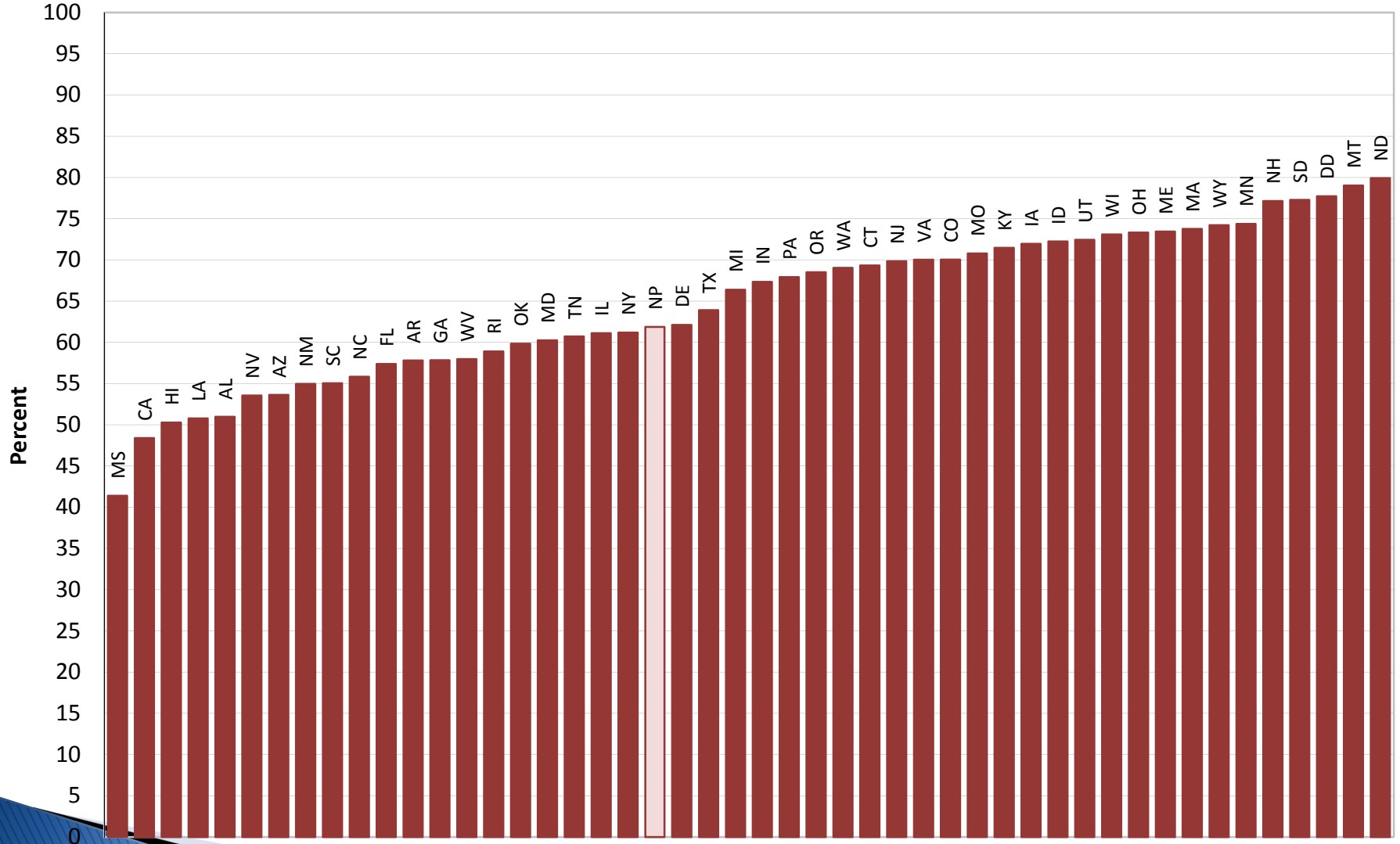
Grade 8



★	Focal state/jurisdiction (South Dakota)
	Higher average scale score than South Dakota (1 jurisdiction)
	Not significantly different from South Dakota (5 jurisdictions)
	Lower average scale score than South Dakota (nation and 40 jurisdictions)
	5 jurisdictions did not participate.

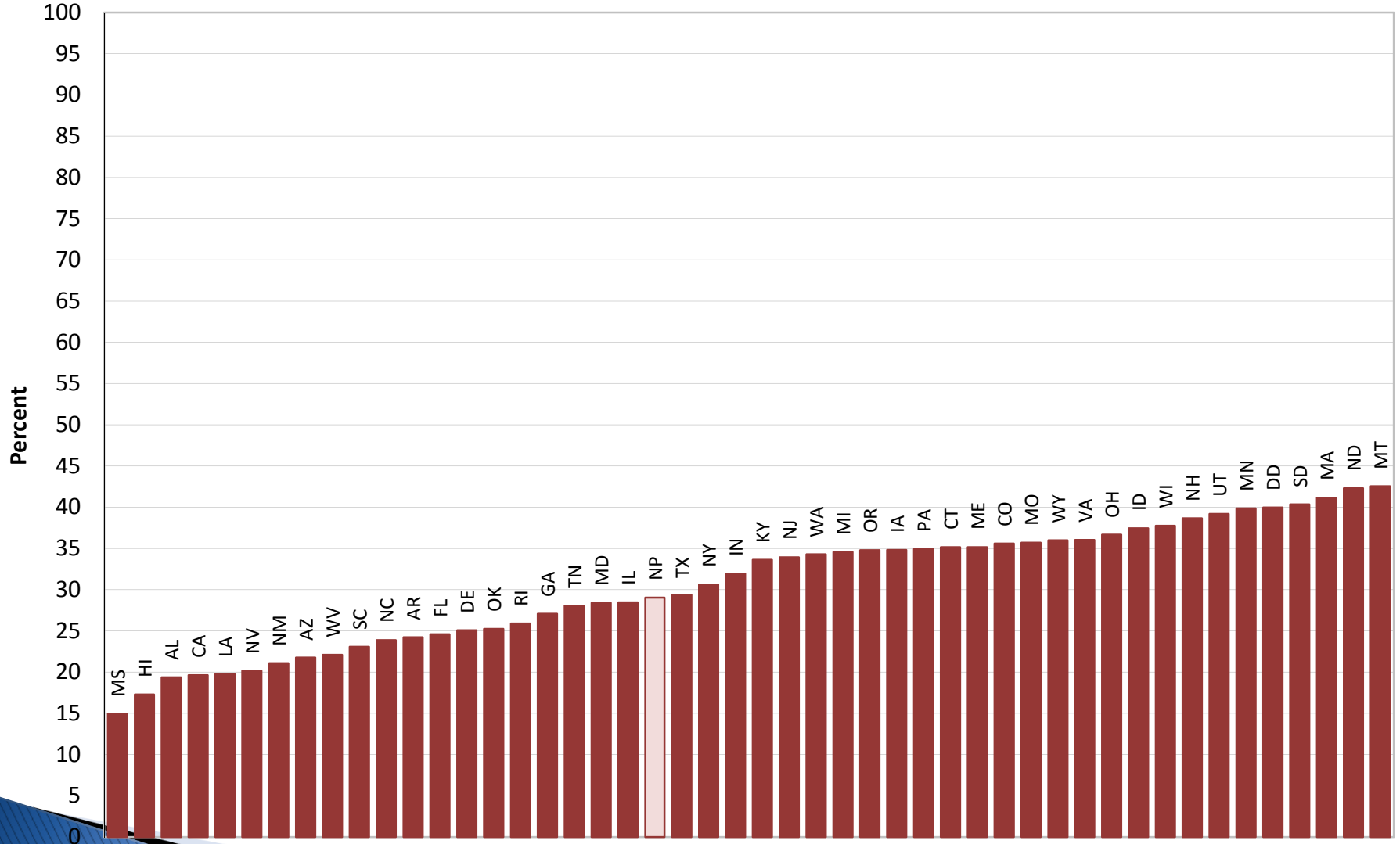
NAEP Science Grade 8 – Overall

At or Above Basic: 2009



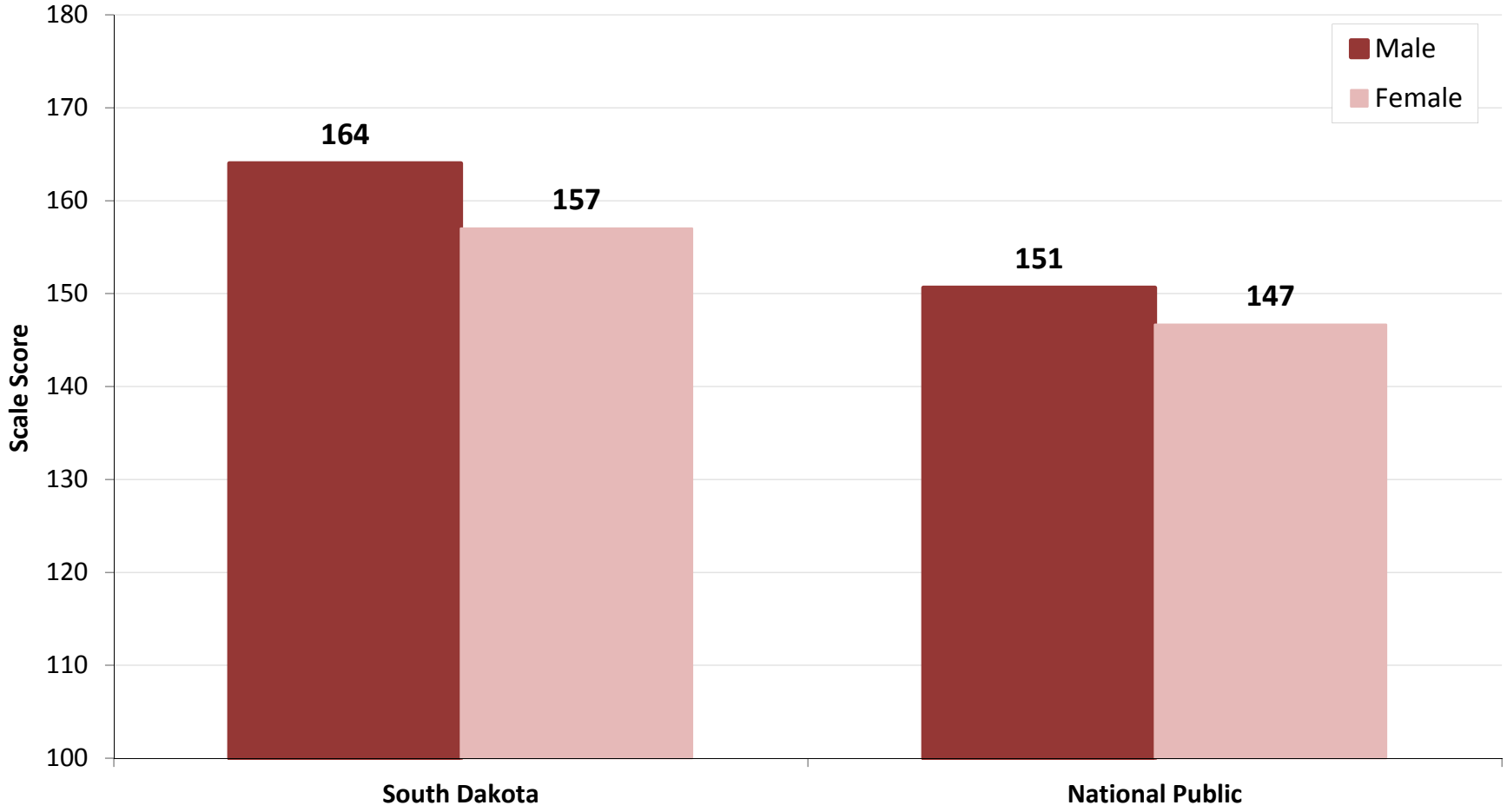
NAEP Science Grade 8 – Overall

At or Above Proficient: 2009



NAEP Science Grade 8 – Gender

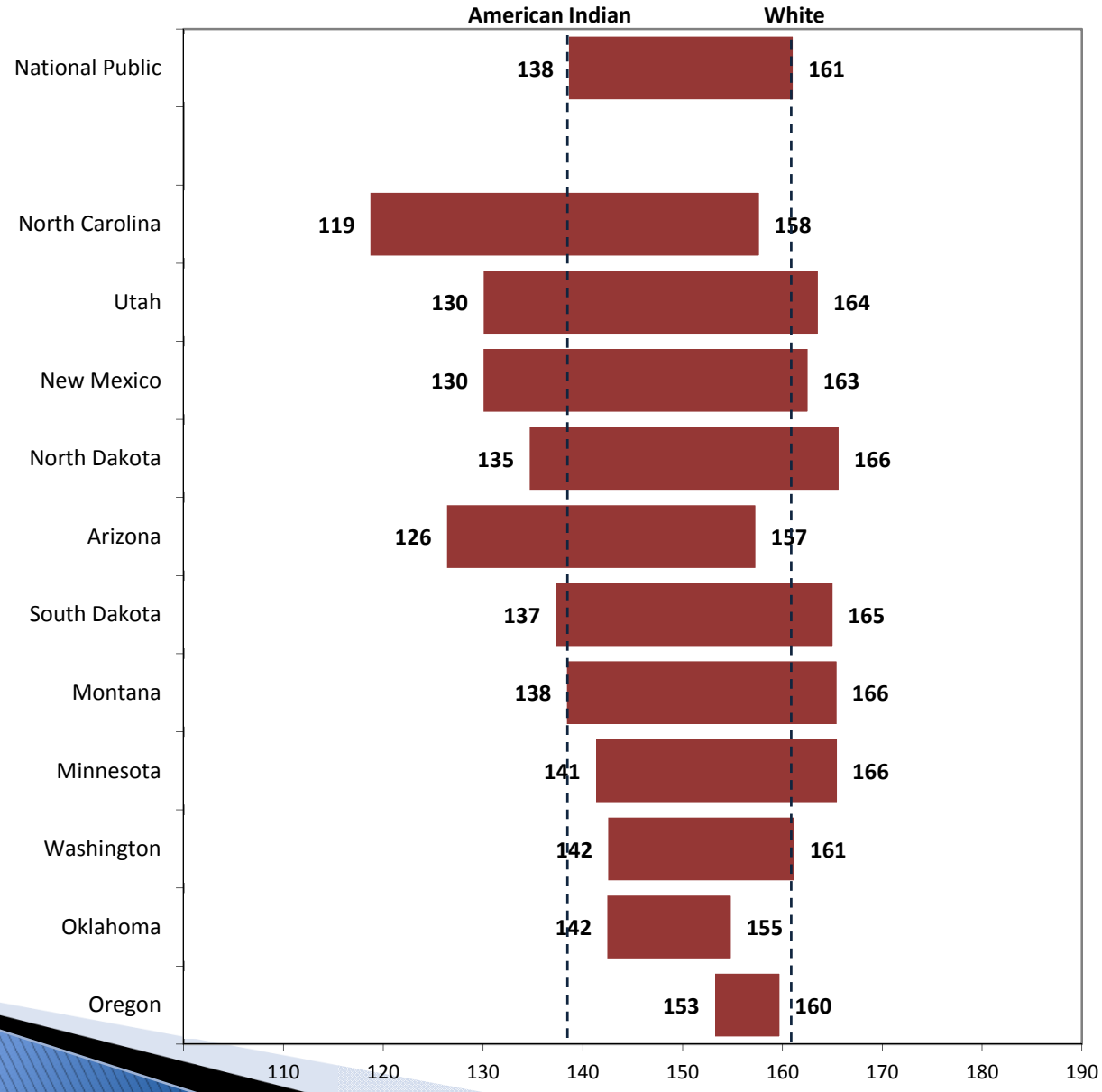
Average Scale Score: 2009



NOTE: The NAEP Science scale ranges from 0 to 300. Observed differences are not necessarily statistically significant.
SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, National Assessment of Educational Progress (NAEP).

NAEP Science Grade 8 – White - American Indian

Gap - Average Scale Score: 2009



4th Grade Sample Question

•When people buy groceries, they may have their groceries packed in plastic bags, paper bags, or cloth bags they bring with them.

Which type of grocery bag is best to use to help protect the environment?

1. Plastic
2. Paper
3. Cloth

Explain why your choice helps protect the environment.

55% of 4th graders nationally had a complete answer

Complete - Student Response

4. When people buy groceries, they may have their groceries packed in plastic bags, paper bags, or cloth bags they bring with them.

Which type of grocery bag is best to use to help protect the environment?

- ○ Plastic
- ● Paper
- ○ Cloth

Explain why your choice helps protect the environment.

I think paper because it doesn't take long for paper witch is made out of trees to become apart of the graund unlike plastic or cloth.

55% of SD students had a complete response with an estimated scale score of 166.
54% of the national public sample had a complete response

Grade 8 Students are in classrooms where…

Use of selected technology to teach science	not at all	small extent	moderate extent	large extent
handheld devices	94%	6%		
graphing calculator	71	21	7	
laptop computer	29	21	25	
DVDs and player	7	32	50	11
digital whiteboard	56	5	9	30
digital project	12	21	10	22
desktop computers	25	18	27	30

Teachers at grade 8

- 93% of students have HQT teachers
- 36% of students have a teacher with a master's degree (165 scale score)
- 59% of the students have a teacher with a bachelor's degree (159)
- 27% of the students have a teacher with 20+ years of teaching experience (167) while another 32% of the students have a teacher with 0-4 years of experience (159)

Gr. 8 Instruction and Curriculum – How do you compare?

- 90% of students in classrooms where teachers make a moderate or large use of state and district assessments to plan and adjust curriculum
- 100% of students … moderate to large use of state standards
- 92% …moderate to large emphasis on E/S science
- 94% … science facts and principles
- 91% … scientific method
- 87% … emphasis on inquiry
- 55% … little or no emphasis on writing in science

Gr. 8 TIMSS Item from 2003

Content Domain	Cognitive Domain
Earth Science	Understanding Complex Information

Oxygen equipment on mountain tops

Why do mountain climbers use oxygen equipment at the top of the world's highest mountains?

A. There is less oxygen in the air at great heights.

B. There is little nitrogen in the air at great heights.

C. There is a hole in the ozone layer.

D. There is no air at the top of very high mountains.

Item Number: F05

Overall Percent Correct		
Singapore	95	▲
Hong Kong, SAR	94	▲
Chinese Taipei	94	▲
Korea, Rep. of	93	▲
Czech Republic	92	▲
Canada	92	▲
Netherlands	91	▲
Slovak Republic	91	▲
Bulgaria	91	▲
Malaysia	90	▲
United States	90	▲
England	90	▲
Hungary	90	▲
Belgium (Flemish)	90	▲
Australia	90	▲
Finland	90	▲
New Zealand	87	▲
Slovenia	87	▲
Russian Federation	84	▲
Israel	80	○
Lithuania	80	○
International Average	**79**	
Iran, Islamic Rep.	79	○
Italy	78	○
Thailand	76	○
Macedonia, Rep. of	75	○
Chile	75	○
Japan	74	▼
Cyprus	70	▼
Romania	70	▼
Latvia (LSS)	69	▼
Indonesia	67	▼
Turkey	65	▼
Moldova	64	▼
Jordan	63	▼
Tunisia	56	▼
Philippines	48	▼
South Africa	44	▼
Morocco	39	▼

Country average vs. International average:	
Higher	▲
Not different	○
Lower	▼

Correct Response:	A

Gr. 8 NAEP 2009 Released Item

Why do mountain climbers at high elevations use oxygen tanks to help them breathe?

A. At high elevations the ozone layer draws oxygen out of the atmosphere.
B. The atmosphere is less dense at higher elevations so there is less oxygen available.
C. Oxygen is heavier than the other gases in the atmosphere and sinks to lower elevations.
D. Radiation from the Sun splits oxygen molecules into atoms making the oxygen unbreathable.

73% of SD students answered correctly.

	A		B*		C		D	
	Avg. Score	**Row Pct.**	**Avg. Score**	**Row Pct.**	**Avg. Score**	**Row Pct.**	**Avg. Score**	**Row Pct.**
Nat. Pub	134	17	155	68	144	10	114	4
South Dakota	**140**	**16**	**163**	**73**	‡	**10**	‡	**1**

NAEP/TIMSS Linking Study at Gr. 8

- The NAEP–TIMSS Linking Study, to be conducted in the first half of 2011, will take a new approach to using grade 8 mathematics and science data from the National Assessment of Educational Progress (NAEP) to project state-level scores on the Trends in International Mathematics and Science Study (TIMSS). The goal of the study is to predict 2011 TIMSS mathematics and science scores at grade 8 based on their NAEP performance for states.

Linking Study cont.

- The study will administer NAEP and TIMSS booklets at the same time under the same testing conditions. This will provide examinee-level correlations between NAEP and TIMSS scores that will be used to improve the accuracy of the predicted TIMSS state scores.
- In 2011, NAEP will add a science assessment at the national and state level during the winter data collection period, as well as another national sample with NAEP-like booklets that contain both NAEP and TIMSS blocks of assessment questions. All 50 states and the District of Columbia have volunteered to take the Science NAEP in 2011.